The Local-Level Management of Climate Change

THESE

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The Local-Level Management of Climate Change: the Case of Urban Passenger Transportation in France

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ABSTRACT

The reduction of GHG emissions is one of the largest and most pressing collective-action problems facing humanity. Addressing this transversal, trans-boundary policy challenge requires action at multiple scales of governance: from behavioral changes by individuals to modifications of local, national and international regulatory frameworks and decision-making processes. Taking an interdisciplinary approach, this project draws on theories on collective action, institutional economics, multilevel governance, and indicators in decision making to analyze what appears to be an increasingly polycentric governance approach to achieving cross-scale action on GHG mitigation. This dissertation addresses the over-arching question of *what governance changes are needed to deliver lasting GHG emissions reductions in the urban passenger transport sector in France?* This analysis suggests that achieving greenhouse gas mitigation is dependent not only on the ability of actors to coordinate action, but also on the information tools needed to integrate these issues into decision-making at multiple levels of government and across policy priorities. Thus, GHG mitigation must be linked as an often-complementary issue with existing policy priorities. The findings resulting from this dissertation have a number of contributions to make both to the theoretical literature as well as to general policy practice and the specific decision-making process in France in terms of transport, urban planning and climate governance.

RÉSUME

La réduction des émissions de gaz à effet de serre (GES) est l'un des problèmes d'action collective les plus importants et les plus urgents auxquels l'humanité doit faire face. Répondre à ce défi politique transversal et transnational semble exiger une action à plusieurs échelles de gouvernance : cela va des changements des comportement individuels à des modifications importantes des cadres réglementaires et des processus de décision locaux, nationaux et internationaux. Adoptant une approche interdisciplinaire, ce projet est élaboré à partir des théories de l'action collective, de l'économie institutionnelle, ainsi que de la gouvernance à multiniveaux et les outils d'expertise afin d'analyser ce qui semble être un modèle de gouvernance « polycentrique » capable d'atteindre les objectifs d'atténuation des GES. Ce projet pose plus globalement la question primordiale de savoir *quels sont les changements de gouvernance nécessaires pour générer des réductions réelles et définitives des émissions de GES dans le secteur du transport urbain de passagers.* Cette analyse suggère que l'atténuation des GES dépend non seulement de la capacité des acteurs de se coordonner, mais également des outils d'information nécessaires pour intégrer ces questions dans la prise de décision à plusieurs niveaux de gouvernance et tributaires des différentes priorités politiques hétérogènes. Les conclusions résultant de cette recherche apportent un certain nombre de contributions à la fois à la littérature théorique, et à la pratique générale de la politique ainsi qu'au processus décisionnel spécifique à la France dans le domaine du transport, de la planification urbaine et la gouvernance climatique.

RESUME LONG FRANÇAIS

1. INTRODUCTION

La réduction des émissions de gaz à effet de serre (GES) est l'un des problèmes d'action collective les plus importants et les plus urgents auxquels l'humanité doit faire face. L'accumulation continue des émissions de GES provenant de sources anthropiques accroît la certitude des changements à grande échelle dans le climat mondial, ainsi que le risque de conséquences catastrophiques. Répondre à ce défi politique transversal et transnational semble exiger une action à plusieurs échelles de gouvernance : cela va de changements de comportement individuels à des modifications importantes des cadres réglementaires et des processus de décision locaux, nationaux et internationaux. Bien que des analyses substantielles des actions individuelles et des politiques visant à réduire les émissions de GES existent, la recherche sur la façon de réaliser leur mise en œuvre généralisée est plus rare. Tenter de résoudre un tel problème d'action collective transversale ayant une portée aussi vaste soulève un certain nombre de questions de gouvernance portant sur les dispositifs institutionnels, sur les mécanismes de coordination ainsi que sur les outils d'information et l'expertise nécessaires pour appuyer la prise de décision. En outre, la gouvernance des politiques d'atténuation des émissions de GES pose un certain nombre de questions sur le rôle des acteurs « sous-nationaux » dans les processus de gouvernance et l'élaboration des politiques. Traitant plus particulièrement du secteur des transports urbains de voyageurs, cette thèse a un double objectif : celui de comprendre comment les objectifs d'atténuation des GES ont été introduits localement dans le contexte institutionnel français et celui d'identifier les informations et l'expertise nécessaires pour assurer l'appropriation et l'intégration ou « *mainstreaming* » de l'atténuation des GES dans l'élaboration des politiques.

Des objectifs ambitieux de réduction des émissions de GES ont été établis du niveau international au niveau local français. Ces objectifs ont souvent mis en place un mandat d'action clair étant donné le périmètre de réductions nécessaires. Néanmoins, dans de nombreux secteurs, il parait difficile de déterminer la meilleure façon d'atteindre ces objectifs. À ce jour, dans le secteur des transports, une grande attention a été accordée au rôle des changements technologiques dans l'atteinte des objectifs. Cependant, il apparaît que des changements dans la demande de mobilité et le comportement des acteurs individuels seront également nécessaires pour atteindre les objectifs. Ainsi, les collectivités territoriales vont avoir un rôle clair à jouer à la fois pour favoriser le déploiement de nouvelles technologies ainsi que pour favoriser un changement de comportement et la réduction de la demande globale en matière de mobilité. Abordée de cette manière, la réalisation des objectifs d'atténuation des GES est étroitement liée aux problèmes de gouvernance rencontrés par les acteurs à différents niveaux de gouvernement pour favoriser l'action collective nécessaire à travers tous les secteurs et les juridictions administratives traditionnels.

2. ACTION COLLECTIVE ET POLYCENTRISME : LES DEFIS DE LA GOUVERNANCE ET LE ROLE DE L'EXPERTISE

Cette thèse a étudié le problème de l'action collective urgente posé par la nécessité de réduire les émissions de GES afin d'éviter de nouveaux changements dans la température moyenne mondiale. Adoptant une approche interdisciplinaire, ce projet est élaboré sur les développements récents en théorie de l'action collective, l'économie institutionnelle et de les ressources tenus en commun (Poteete et al 2010;. Ostrom 2009; Dietz et al 2008), les théories sur la gouvernance à multiniveaux et polycentrique (Ostrom 2009; Hooghs & Marks 2003) et les outils de gouvernance et de l'expertise (Cash & Moser 2008; Lascoumes et Légales 2004) afin d'analyser ce qui semble être un modèle de gouvernance « polycentrique » capable d'atteindre les objectifs d'atténuation des GES. En plaçant cette recherche dans ce cadre théorique, ce projet pose plus globalement la question primordiale de savoir *quels sont les changements de gouvernance nécessaires pour générer des réductions réelles et définitives des émissions de GES dans le secteur de transport urbain de passagers*. En utilisant cette question comme point de départ, cette thèse a traité deux autres questions étroitement liées portant sur le secteur des transports urbains de voyageurs en France:

- *Comment les défis de gouvernance influencent-ils l'expertise nécessaire pour informer et conduire l'atténuation de GES dans le processus décisionnel de transports urbains de passagers en France?*

- *Qu'est-il nécessaire au développement d'une expertise crédible, légitime et pertinente pour le processus décisionnel de transports urbains de passagers ?*

Pour ce faire, l'analyse a étudié le croisement des actions politiques spécifiques de réductions de GES, le contexte institutionnel au sein duquel évoluent la gouvernance des transports, l'urbanisme et la politique contre le changement climatique ainsi que les outils d'information nécessaires pour guider l'élaboration des politiques et favoriser un encadrement commun de cet important défi. Les questions ont été traitées dans le cas concret du transport urbain de passagers en France afin d'analyser les défis de gouvernance posés par la nécessité de fédérer l'action à travers les multiples niveaux de gouvernement ainsi que les processus de prises de décisions sectorielles. La littérature sur la planification des transports et de l'urbanisme présente souvent un consensus sur les politiques et les actions nécessaires pour réduire les émissions de GES. Cette recherche doctorale a exploré les façons dont ces actions peuvent être déployées dans un contexte institutionnel donné, afin d'atteindre les objectifs ambitieux d'atténuation qui ont été établis aux niveaux international, national et local. Plutôt que de se concentrer sur l'étude politique d'un seul cas précis ou d'une décision, cette recherche a pour but de comprendre comment les cadres institutionnels et les outils d'information liés aux GES peuvent être structurés de manière à assurer l'intégration de l'atténuation des GES dans le processus décisionnel, quels que soient le contexte politique et son évolution.

La section 1 a adopté une approche théorique pour comprendre l'action collective liée au changement climatique, les mécanismes institutionnels et les outils nécessaires à sa gouvernance ainsi que le rôle des différents acteurs aux différents niveaux de gouvernement. Le chapitre 1 a montré que l'application de la théorie de l'action collective à l'atténuation des

GES définit un cadre dans lequel les mécanismes de coopération et de coordination ainsi que les informations sur les émissions de GES sont des éléments clés dans la mise en place d'un changement de comportement et le développement d'un cadre politique commun. Dans le chapitre 2, l'analyse indique que les acteurs locaux ont un rôle important à jouer dans la réduction des émissions de GES grâce à l'élaboration et à la mise en œuvre de politiques locales d'atténuation complémentaires aux politiques réglementaires et fiscales nationales et internationales. Cela est dû non seulement à la répartition actuelle des compétences administratives et légales en matière de planification des transports et d'urbanisme, qui doit être traitée en parallèle, mais aussi de la proximité des autorités locales par rapport aux parties prenantes et aux groupes d'acteurs en vue de faciliter le déploiement d'actions et de favoriser un climat d'apprentissage et d'appropriation.

La section 2 a exploré la façon dont les contextes institutionnels spécifiques à la France liés aux politiques de transport et de planification urbaine, ainsi que la structure politique en place pour lutter contre le changement climatique, favorisent ou limitent la réduction des émissions de gaz à effet de serre. Le chapitre 3 suggère que même si un certain nombre de mécanismes, d'instruments politiques et de modifications institutionnelles a été introduit, le contexte institutionnel pour le transport et l'urbanisme en France continue de présenter un environnement politique fragmenté. Ceci empêchant encore la coordination et limitant les ressources et la capacité nécessaire pour développer suffisamment l'atténuation des GES et atteindre les objectifs. Cela a illustré l'importance de modifier les arrangements institutionnels lorsque cela est possible, tout en développant des processus de coordination entre les acteurs afin de s'affranchir des frontières traditionnelles (politique et opérationnelle) ainsi qu'en développant un langage et une compréhension communs des objectifs politiques existants souvent synergiques avec l'atténuation des GES. En regardant le cas spécifique de la politique climatique en France, le chapitre 4 a identifié les Plans Climat Energie Territoriaux (PCET) et les outils d'information associés comme étant clés dans le processus dynamique visant à favoriser la coordination ainsi que les informations et l'expertise nécessaires pour la prise de conscience généralisée des questions climatiques au sein des autorités locales. Bien que ces outils sont une première étape importante dans le développement d'une « culture du climat », ils ont cependant, jusqu'à présent, été moins efficaces dans l'élaboration des politiques sectorielles influençant les transports.

Ainsi, la Section 3 a été basée sur les deux sections précédentes afin d'explorer à la fois comment les outils d'information et l'expertise sont utilisés pour favoriser cette nécessaire intégration sectorielle ainsi que les implications du développement d'une large gamme d'outils liés aux GES sur leur appropriation, leur structure méthodologique et leur production. Le Chapitre 5 a exploré la façon dont, à ce jour, les questions climatiques ont été intégrées ou «*mainstreamed* » directement dans la prise de décision dans le secteur des transports avec un focus particulier sur les plans de déplacements urbains (PDU). Cette analyse montre que la pertinence de l'intégration sectorielle des critères d'atténuation des GES est limitée d'une part par des lacunes dans l'intégration de critères environnementaux en général (calendrier, scénarios), et d'autre part par les aspects techniques des outils utilisés (méthodes, quantification, portée des outils, liaison avec d'autres priorités politiques). Cette analyse suggère qu'un certain nombre de limitations demeure pour passer de l'expertise à l'identification et l'appropriation de l’ensemble des actions et des politiques nécessaires pour réduire les émissions. Enfin, le Chapitre 6 a identifié une hiérarchie naissante ou « système d'information » autour des outils d'information sur les GES développés pour des usages multiples et des applications différentes. Cela a un certain nombre d'implications pour la production et l'appropriation de l'information par les décideurs car il semble y avoir un besoin d'harmoniser un certain nombre de choix méthodologiques de base ainsi que de développer des partenariats et des compétences internes nécessaires pour favoriser la « co-construction » de l'expertise.

Peut-être plus important encore, cette recherche a indiqué que la réalisation de l'atténuation des GES et d'autres objectifs généraux liés au changement climatique dépend non seulement de la capacité des acteurs de se coordonner mais également des outils d'information nécessaires pour intégrer ces questions dans le processus de prise de décision à plusieurs niveaux de gouvernance et tributaires aux différentes priorités politiques hétérogènes. Ainsi, l'atténuation des GES doit être posée en tant que question souvent complémentaire aux priorités politiques existantes. L'analyse et les conclusions résultant de cette recherche apportent un certain nombre de contributions à la fois à la littérature théorique, et à la pratique générale de la politique ainsi qu’au processus décisionnel spécifique à la France dans le domaine du transport, de la planification urbaine et la gouvernance climatique.

3. LEÇONS POUR LA POLITIQUE PUBLIQUE

Les chapitres ci-dessous explorent un certain nombre de questions de gouvernance, parmi lesquelles : les actions nécessaires pour réduire les émissions dans le secteur de transport urbain de passagers, les parties prenantes ayant besoin d'être impliquées dans ce processus étant donné les différentes configurations institutionnelles, la façon avec laquelle la structure de prise de décision influence l'intégration de l'atténuation des GES, et enfin, la manière dont les outils d'information sur les GES influencent l’appropriation de l'expertise et son intégration dans l'élaboration des politiques. Au travers de l'analyse du contexte institutionnel pour l’élaboration et la mise en place des politiques de transports, d'urbanisme et climatiques en France, cette thèse a identifié un certain nombre de leçons pour la pratique politique.

Tout d'abord, un certain nombre de conclusions générales peuvent être tirées concernant les actions, les configurations institutionnelles, les processus de décision et les outils nécessaires pour la gouvernance des émissions de GES :

• *Quoi ?* : La réduction des émissions dans le secteur des transports urbains de voyageurs nécessite la coordination des politiques de transport et à de multiples niveaux de gouvernance et entre les multiples secteurs politiques. (Chapitres 1 et 2)

• *Qui ?* : Les configurations institutionnelles infra-sectorielles et entre les niveaux de gouvernement et la structure des mécanismes de coordination (plans climat, etc.) influencent la capacité des collectivités et des autres acteurs locaux à traiter l'atténuation des émissions de GES ; ceci s’explique par la fragmentation des compétences, la juridiction ainsi que les limitations sur les ressources et les capacités. (Chapitres 3 et 4)

• *Comment ?* : La structure du processus de prise de décision permet ou limite l'intégration ou la prise en compte de l'atténuation des GES dans les politiques et les actions. (Chapitres 4 et 5)

• *Par quels outils ?* : La perception de la crédibilité, de la légitimité et de la pertinence des outils d'information utilisés dans le processus politique influe sur leur appropriation par les acteurs et l'intégration de l'expertise sur les émissions de GES dans le processus politique, et donc, sa capacité à influencer les choix de politiques individuelles. (Chapitres 5 et 6)

Sur la base de cette analyse du contexte français, un certain nombre de conclusions peuvent être tirées au sujet de la politique publique. Tout d'abord, le déploiement des plans climat (PCET) représente une étape importante pour l'instauration d'une dynamique climatique à l'échelle « macro » dans les collectivités et dans la population en générale. A ce titre, elles semblent prendre d'importantes mesures pour encadrer l'atténuation des GES en tant que priorité politique pour l'autorité locale ainsi que dans l'ensemble des secteurs. Cependant, ces plans semblent moins capables d'intégrer des critères de GES dans les processus décisionnels sectoriels eux-mêmes. Comme on le voit dans les deux études de cas examinées ici, l'intégration sectorielle ou le « *mainstreaming* » des critères de GES dans le processus décisionnel en matière de transports a plutôt commencé à se produire dans le but d'influer directement sur les choix et les orientations stratégiques en cours d'établissement.

Deuxièmement, dans les processus de gouvernance, l'information et l'expertise sur les émissions de GES jouent un rôle clé. Un large éventail d'outils d'information de GES sont en cours d'élaboration pour des utilisations allant de la mise en place d'un plan climat dynamique - tels que les inventaires d'émissions liées à l'activité ou bien au territoire - à l'analyse détaillée du « cycle de vie » pour des politiques ou des services précis (traitement des déchets, approvisionnement, etc.). Cependant, le déploiement d'une gamme d'outils aussi large a des implications sur leur appropriation par des acteurs différents ainsi que sur leur développement. Il semble y avoir besoin d'une base minimale d'harmonisation des approches méthodologiques et des définitions afin de s'assurer que les résultats soient à la fois crédibles et pertinents. Cette analyse indique que l'internalisation par les collectivités de la capacité technique pour l'élaboration d'informations sur les GES, ainsi que la création de partenariats à long terme avec des organismes techniques, sont des étapes importantes pour s'assurer que l'information est à la fois techniquement solide et pertinente pour la prise de décision.

Troisièmement, même dans un contexte français de gouvernance où il existe une culture forte et ancienne de planification, de coordination et d'évaluation des plans et des projets, l'introduction de critères de GES n'est pas nécessairement un processus qui produira des résultats immédiats. Allant au-delà des questions sur le changement climatique, il apparaît que les documents de planification et les évaluations de projet sont utilisés souvent d'une façon superficielle comme des exercices *ex-post* plutôt que comme une analyse de scénarios concurrents pour le développement (calendrier et scénarios). Néanmoins, ces documents jouent un rôle important dans la fixation des limites sur les types d'activités de développement qui peuvent se produire, et donc représentent un sorte de filet de sécurité pour se prémunir des impacts environnementaux et sociaux négatifs. En tant que tel, il y a peu de doute que l'élaboration du plan de déplacements urbains (PDU) soit importante et que ce processus puisse conduire à la production d'un document concret et d'un programme cohérent de développement des transports qui s'étendrait sur cinq à dix ans. Ce caractère non réversible d'une stratégie et d'un programme d'actions encourage non seulement la cohérence entre les différents secteurs tels que les transports et l'urbanisme et les outils de planification, mais offre également à la stratégie de transport, une fois approuvée, une certaine mesure de protection contre les changements politiques. Néanmoins, ils apparaissent souvent incapables d'introduire le changement systémique nécessaire pour réduire les émissions de GES à l'échelle suffisante pour atteindre des objectifs ambitieux de réduction des émissions de 2050.

4. RECOMMANDATIONS POLITIQUES POUR LE CONTEXTE FRANÇAIS

Comme on le voit dans les chapitres 2, 3, 4, 5 et 6, cette analyse a conduit à un certain nombre de recommandations en termes d'orientations stratégiques pour l'élaboration des politiques publiques et leur mise en œuvre. Ces stratégies sont ventilées dans chaque section par des « orientations stratégiques », des « stratégies de politique générale » applicables dans des contextes institutionnels pour les gouvernements nationaux et locaux, et des « recommandations spécifiques » pour la France et les deux cas étudiés dans cette thèse. Cette section présente les recommandations les plus pressantes pour les décideurs nationaux et locaux en France. Elle met l'accent sur les mesures nécessaires pour assurer l'intégration à long terme ou le « mainstreaming » des impacts du changement climatique et l'atténuation des GES dans le processus décisionnel.

4.1. Réduire les émissions de GES par une meilleure coordination des politiques de transport et d'urbanisme

Comme on le voit dans les chapitres 2 et 3, la réduction des émissions de gaz à effet de serre dans le secteur des transports urbains de voyageurs nécessite un large éventail d'actions coordonnées à travers l'ensemble des secteurs du transport et de l'urbanisme. Veiller à ce que le développement urbain se produise de façon à réduire la demande de la mobilité tout en accompagnant le développement d'infrastructures de transports publics pouvant répondre à cette demande est la clé de la réduction des émissions. En outre, la planification urbaine et la politique des transports ont un rôle à jouer dans le déploiement de nouvelles technologies à faibles émissions étant donné l'utilisation inévitable des véhicules personnels. À ce jour, les documents d'urbanisme (PLU - Plan Local d'Urbanisme, PLH - Programme Local de l'Habitat, SCOT - Schéma de Cohérence Territoriale) et le document de planification des transports, le PDU, ont adopté un certain nombre de mesures et d'actions nécessaires pour réduire les émissions. Toutefois, d'autres actions semblent encore nécessaires pour atteindre les objectifs d'atténuation des GES.

Au niveau national, un certain nombre de modifications du cadre général des secteurs du transport et de l'urbanisme est nécessaire pour faciliter une meilleure coordination de la politique ainsi que l'intégration de l'atténuation des GES. Tout d'abord, la gouvernance du transport et de la planification urbaine, ainsi que du PDU et du PLU, devrait être attribuée au niveau intercommunal pour assurer une meilleure coordination. Néanmoins, les communes et les autres parties prenantes doivent également y participer pour garantir la continuité de la légitimité et la mobilisation des savoirs locaux. En outre, des actions sont nécessaires pour assurer la cohérence du périmètre de transports urbains (PTU) avec le bassin de transport réel, bien qu'il soit reconnu qu'un équilibre doit être trouvé en termes de la couverture du bassin et l'augmentation des revenus provenant du *versement transports*. Enfin, il apparaît nécessaire de mettre en place un organe d'exécution et d'application des SCOT, sous la supervision conjointe des collectivités concernées, fonctionnant à l'échelle de toute la zone urbaine.

Au niveau local, en attendant des modifications du cadre national, un certain nombre de changements peuvent être mis en œuvre pour gérer le transport et la politique de planification urbaine à l'échelle de la structure intercommunale. Cela inclut le transfert par les communes de compétences des infrastructures de transport (voirie) ainsi que les compétences d'urbanisme (PLU) des communes à la structure intercommunale. En outre, les structures intercommunales elles-mêmes et les AOTUs (Autorité organisatrice de transports urbains) peuvent choisir de fédérer la gestion des transports dans un *Syndicat Mixte SRU* afin d'étendre la cohérence de la planification des transports aux territoires adjacents. Enfin, les mécanismes et les outils contractuels comme les « contrats d'axe » doivent être mis à profit pour favoriser la coordination entre les transports et les processus d'urbanisme.

4.2. Améliorer la gouvernance climatique : les plans climat et l'intégration sectorielle des critères GES

Comme on le voit dans les chapitres 3 et 4, les plans climat se sont développés et déployés de façon significative en France au cours de la dernière décennie. Néanmoins, même si cette étape est importante, elle ne semble cependant pas suffisante pour assurer l'intégration des informations et de l'expertise sur le climat dans les processus de décisions sectorielles, dans lesquels un grand nombre de choix importants concernant les voies de développement à moyen et à long terme est fait. Les acteurs nationaux et les collectivités doivent continuer à chercher à identifier et établir le périmètre le plus pertinent pour l'action. Cela comprend la mise en place de moyens pour faciliter la coopération entre les périmètres institutionnels existants.

L'actuel cadre national français pour le changement climatique a donné un mandat implicite pour l'action grâce à l'adoption de l'ambitieux objectif de réduction de 75% des émissions de GES d'ici 2050. Néanmoins, à ce jour, le cadre a fait peu de progrès dans la fourniture ou l'identification des sources de financement nécessaires pour l'action à la fois aux niveaux national et local. Alors que le financement sectoriel a été disponible pour certaines initiatives plutôt axées sur des projets, les ressources sont également nécessaires pour les collectivités pour qu'elles puissent mener les études de diagnostic nécessaires et pour financer à long terme l'action dynamique et la mise en œuvre du plan climat (équipe, expertise). Il faut également faciliter l'intégration des critères d'atténuation des émissions de GES dans le financement sectoriel établi à l'échelle nationale pour assurer la cohérence des objectifs dans tous les secteurs. Bien que la responsabilité croissante exercée par les collectivités pour résoudre les questions du changement climatique doit être accompagnée par des ressources financières et des outils fiscaux nécessaires, à ce jour peu de développement a eu lieu dans ce domaine.

Un certain nombre d'orientations et de stratégies, ainsi que des actions spécifiques pour les deux études de cas de cette thèse, peuvent être identifiées pour des structures intercommunales. Les autorités locales doivent travailler à développer la dynamique et le processus didactique nécessaire pour coordonner les actions transversales qui sont de plus en plus décentralisées dans le cadre des actions d'atténuation des GES. Les structures intercommunales ont un rôle important à jouer pour fournir une assistance technique aux autres acteurs. Ceci nécessite le développement d'une capacité interne de traiter le sujet, lorsque cela est possible, ainsi que la mise en place de partenariats à long terme avec les organismes techniques locaux. En outre, le développement de l'information et d'une gamme d'outils de mesure des GES nécessaires pour gouverner l'atténuation des GES sont deux processus clés. L'on peut également tirer un certain nombre de leçons des deux structures intercommunales étudiées. Alors que Grenoble Alpes Métropole a travaillé avec ses différents partenaires pour établir des actions d'atténuation des émissions de GES, le processus de quantification « 100 Actions » lancé par Nantes Métropole pourrait être un moyen supplémentaire d'aider tous les services dans la compréhension de l'impact de leurs actions sur les émissions. En échange, la « Charte d'engagements », modèle déployé par Grenoble Alpes Métropole pourrait offrir un certain nombre de leçons dans l'engagement et la fédération d'une variété de groupes d'acteurs dans le processus d'atténuation. En outre, Nantes Métropole doit poursuivre ses efforts pour développer un inventaire annuel des émissions de suivi, tant au niveau interne qu'à l'échelle du territoire.

L'intégration de l'expertise sur les GES dans la prise de décision sectorielle doit également avoir lieu. Un certain nombre de changements sont nécessaires pour la faciliter tant au niveau national que local. Des difficultés liées à l'intégration du changement climatique sont liées aux problèmes plus vastes de l'intégration des questions environnementales en général dans le processus décisionnel. De cette manière, le cadre national doit exiger que l'évaluation environnementale commence tôt et se poursuive tout au long du processus décisionnel de planification. En outre, des ressources supplémentaires sont nécessaires pour les préfets chargés de l'analyse de ces documents pour assurer la vérification des évaluations environnementales et le rôle des outils d'information de GES dans le processus décisionnel. Les acteurs locaux ont aussi un rôle à jouer à travers la production de scénarios plus robustes pour aider le processus de prise de décision et pouvoir comparer différentes combinaisons de programmes d'action afin d'identifier plusieurs voies de développement à faibles émissions. En outre, des mesures devraient être prises pour établir un lien entre le SCOT et les scénarios PDU pour faciliter les connexions entre le transport et l'urbanisme.

4.3. Outils d'information pour la prise de décision : méthodes, hiérarchie et appropriation

Comme on le voit tout au long de cette thèse, et en particulier dans les chapitres 5 et 6, les outils d'information et d'expertise sur les émissions de gaz à effet de serre ont un rôle important à jouer dans les processus de gouvernance. Cette recherche a identifié un certain nombre de recommandations sur l'information utilisée afin d'améliorer l'intégration des critères climatiques dans la prise de décision et la planification sectorielle ainsi que sur le développement d'un "système d'information" ou d’une hiérarchie des outils de GES adaptés à un éventail d'utilisations.

Un certain nombre de sujets techniques pour l'intégration sectorielle dans le processus de prise de décision liée aux transports doit être abordé. Tout d'abord, une révision de la structure de l'analyse coûts-avantages peut être nécessaire afin de réviser les valeurs de base des objectifs ambitieux de la France pour 2050. Même avec un prix égal à 350 € / tonne de CO_2 (objectif provisoire de l'État pour 2050), les bénéfices dus aux réductions de GES pour un projet comme le tramway ligne E à Grenoble restent inférieurs à 3% du total des gains (voir chapitre 5). A ce titre, il semble qu'une réflexion plus approfondie soit nécessaire pour mieux prendre en considération les coûts environnementaux à long terme et les bénéfices économiques (gain de temps) à court terme dans l'analyse coût-bénéfice. Deuxièmement, la façon de mener une analyse multicritères a été peu formalisée jusqu’à présent : les méthodes restent très hétérogènes et potentiellement ouvertes aux biais introduits par les personnes chargées de l'analyse. Une évolution vers une évaluation qualitative, telle que l’analyse multicritères menée par Nantes Métropole dans le développement de leur PDU 2010, pose un certain nombre de questions. La robustesse de cette analyse multicritères qualitative ainsi que sa capacité à refléter avec précision les impacts potentiels sur les émissions de GES restent relativement non testés. A ce titre, il apparaît important que l’Etat travaille avec les parties prenantes nécessaires pour mettre au point une méthodologie robuste.

Le développement d'un "système d'information" sur les émissions de GES exige des actions à plusieurs niveaux. Au niveau national, favoriser la production de cet outil d'information sur les GES peut nécessiter à la fois la création d’un mandat pour le faire, qu'il soit volontaire ou obligatoire, et la mise à disposition de ressources pour mettre en place des programmes de quantification initiaux. L'État a également un rôle à jouer en fournissant les ressources techniques nécessaires pour produire les inventaires et les bilans en travaillant avec les acteurs existants et en reconnaissant leurs rôles clés, tels que les AASQA (Association agréée de surveillance de la qualité de l'air) en France, ainsi que d'autres organisations nationales (ADEME) et les collectivités. En outre, l'État doit promouvoir la cohérence dans l'application des outils d'information de GES. La production de lignes directrices pour les inventaires d'émissions internes, comme c’est déjà le cas en France, ainsi que pour les approches territoriales, peuvent établir les définitions de base nécessaires et les méthodes qui peuvent être adaptées à différentes applications tout en gardant un niveau de cohérence.

En France, les collectivités locales et en particulier les structures intercommunales, ont un rôle à jouer dans la production, l'appropriation et la cohérence des informations et de l’expertise sur les GES. La crédibilité et la légitimité de l'information produite peut être assurée et améliorée à travers le développement d'une capacité technique interne sur la quantification des émissions de GES, que ce soit sous la forme d'un « boundary actor » ou d’une « boundary agency » (c.f. chapitre 6). En outre, le développement de partenariats à long terme avec les organisations d'expertise technique, telles que les AASQA, joue un rôle dans l'amélioration de la qualité technique ainsi que dans la mise en cohérence des outils à travers le temps. La cohérence peut être également assurée par l'adoption d'approches nationales ou régionales assez flexibles pour s'adapter aux besoins locaux. En outre, l'harmonisation interne des définitions de base et des méthodes parmi les outils élaborés par la structure intercommunale est une étape importante à laquelle, à ce jour, les deux structures étudiées ici doivent faire face. Enfin, favoriser l'appropriation de l'information exige que la production de l'expertise des émissions de GES et les résultats soient intégrés dans les processus de décision en temps opportun. Cela exige souvent que les résultats soient liés aux autres priorités politiques pour améliorer la compréhension et l'approbation par les acteurs.

Enfin, l'analyse ci-dessus indique que les acteurs régionaux ont aussi un rôle à jouer dans l'amélioration de la cohérence et la production d'inventaires de GES. Cette recherche a identifié le partage des ressources et des données à l'échelle régionale dans un certain nombre d'endroits en France sur des sujets liés aux émissions de GES. Des centres d'expertise régionaux, soit par le biais d'associations ou d'organismes parrainés par l'État, ont un rôle à jouer en aidant les autorités urbaines, comme c'est le cas à Grenoble Alpes Métropole et à Nantes Métropole, dans le développement de leurs inventaires de GES au niveau territorial. En outre, ils ont également le potentiel d'être des acteurs clés pour aider des petites villes et les zones rurales avec la quantification de leurs émissions de GES. Ces structures régionales peuvent également représenter des intermédiaires importants dans le processus d'harmonisation des approches méthodologiques, car ils peuvent à la fois influencer le développement de lignes directrices et les normes nationales en se fondant sur leur expérience acquise en travaillant avec les acteurs locaux, ainsi que favoriser l'adoption d'approches harmonisées par leurs partenaires.

5. DES REMARQUES FINALES ET DES QUESTIONS POUR LES FUTURES RECHERCHES

La réduction des émissions de gaz à effet de serre provenant de sources anthropiques représente l'un des problèmes les plus importants d'action collective auquel l'humanité doit faire face. Grâce à l'analyse du contexte institutionnel français et de deux études de cas, il semble certain que la réalisation d'un cadrage commun, l'appropriation d'actions d'atténuation de GES et la coopération à travers les différents niveaux de gouvernement ainsi que transversalement ne seront pas une tâche facile. À ce titre, « comment » réduire les émissions de GES est tout aussi important que l'analyse continue de « ce qu'il faut faire ». Comme on le voit dans le secteur des transports urbains de voyageurs en France, la réduction des émissions provient de la révision d'un certain nombre d'actions existantes (échelle, portée, coordination). Dans ce processus, un modèle polycentrique de gouvernance semble offrir un certain nombre de leçons pour l'organisation de l'action autour d'un sujet transversal, au-delà des frontières traditionnelles, des juridictions et des définitions sectorielles. Les collectivités et les acteurs locaux doivent être de plus en plus impliqués dans l'atténuation des émissions de GES afin d'atteindre les objectifs ambitieux d'ici 2050. Ainsi il sera important de continuer à observer si le modèle polycentrique continue d'être pertinent pour étudier des évolutions dans la gouvernance du changement climatique.

Cette thèse a également identifié l'importance croissante de l'intégration du changement climatique dans les processus décisionnels sectoriels. Alors que la dynamique des plans climat semble importante pour assurer que l'atténuation des gaz à effet de serre devienne et demeure une priorité politique au sens large, l'intégration des critères climatiques dans différents processus décisionnels semble être un élément clé. Poussée à sa conclusion logique, l'intégration du changement climatique sera un moyen d'influencer les grands processus décisionnels et dans de nombreux cas, de donner le coup d'envoi nécessaire pour passer à de nouvelles voies de développement « bas-carbone ». Dans ce processus, les outils d'information ont un rôle important dans l'élaboration d'un langage commun sur les questions du climat - et donc l'établissement d'un encadrement commun et l'échange d'expériences avec les autres acteurs. Avec l'intégration continue des critères et des indicateurs de GES, d'autres recherches seront nécessaires pour comprendre comment cette expertise est prise en compte dans l'ensemble des processus décisionnels, au-delà des documents de planification. Les leçons tirées des « systèmes d'information » climatiques peuvent offrir un certain nombre d'enseignements utiles pour diverses décisions, du financement des infrastructures à la gestion des portefeuilles d'investissement.

Comme il est indiqué ci-dessous, la portée de cette thèse, son accent mis uniquement sur le contexte institutionnel français, un secteur politique unique et l'analyse restreinte à deux études de cas françaises limitent la généralisation à grande échelle des conclusions mentionnées ci-dessus. A ce titre, des recherches supplémentaires pourraient voir le jour. Tout d'abord, il apparaît nécessaire de prendre les leçons de cette thèse et d'analyser d'autres cas (autorités urbaines) ainsi que d'autres secteurs (logement, industrie) en France. Cette thèse a adopté une approche descriptive, dans le but de servir de base pour une recherche comparative future, afin que la gouvernance climatique dans le contexte institutionnel français puisse être comparée avec d'autres cadres nationaux. Enfin, une analyse « en continue » sera nécessaire pour déterminer si les moyens actuels de gouvernance nationale et territoriale d'atténuation des gaz à effet de serre en France seront suffisants pour passer de réductions « marginales » des émissions à des changements « systémiques ». Cette transition semble nécessaire afin d'atteindre non seulement les objectifs de réduction des émissions pour 2050, mais aussi afin d'éviter les impacts du changement climatique potentiellement catastrophiques auxquels le monde est confronté.

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INTRODUCTION

1. CLIMATE CHANGE, COLLECTIVE ACTION AND TRANSPORTS

The reduction of GHG emissions is one of the largest and most pressing collective–action problems facing humanity. The continued buildup of greenhouse gas emissions from anthropogenic sources is increasing the certainty of large-scale changes in the global climate as well as the risk of catastrophic impacts. Addressing this transversal, trans-boundary policy challenge requires action at multiple levels of governance: from behavioral changes by individuals to modifications of local, national and international regulatory frameworks and decision-making processes. While substantial analysis of the individual actions and policies needed to reduce greenhouse gas emissions has already occurred, to date little analysis is available on *how* to achieve their widespread implementation. Attempting to solve such a broad-reaching and transversal collective–action problem raises a number of governance issues, touching on institutional arrangements, mechanisms and incentives for coordination as well as the needed information tools and expertise to support decision making. Further, the governance of GHG mitigation policy poses a number of questions on the role of sub-national actors in governance processes and policymaking. Focusing on the urban passenger transport sector, this dissertation has a double objective of understanding how greenhouse-gas mitigation objectives have been introduced within the French institutional context for sub-national action along with identifying the information and expertise necessary to ensure the appropriation and integration or 'mainstreaming' of GHG mitigation into policymaking.

2. POLICY CONTEXT FOR RESEARCH

Ambitious greenhouse gas emission objectives have been established from the international level to the local level in France. These objectives have often set a clear mandate for action, given the scope of reductions necessary. However, in many sectors it remains unclear as how to achieve the set targets best. To date in the transport sector, significant attention has been paid to role of technological changes in achieving targets; however, it appears that changes in the demand for mobility and the behavior of individual actors will equally be necessary to achieve goals. As such, there is a clear role for sub-national authorities in both fostering the deployment of new technologies and creating the context for behavioral change and the reduction for the overall demand for mobility. Framed in this manner, achieving GHG mitigation targets is closely linked to challenges faced by actors at multiple levels of governance to facilitate the necessary collective action across sectors and traditional administrative jurisdictions.

2.1. Ambitious Global Emission Reductions, Notably for the Transport Sector

The third assessment report of the IPCC[1] has indicated that global emissions must be divided in half in order to achieve the international emission reduction target of keeping global atmospheric concentrations of GHG emissions below 450 parts per million by 2050 and, thus, keeping mean global temperature increases at 2˚C. Developed countries must,

[1] International Panel on Climate Change

therefore, divide their emissions fourfold (75%) (Metz 2001). As such, European countries in general, and France in particular, have made ambitious greenhouse gas emission reduction commitments as seen in Table 1. France has established three increasingly ambitious greenhouse gas reduction targets, each representing a different time horizon. In the short term, the country is well on its way to respecting its target of stabilizing GHG emissions (0% reduction target) during the Kyoto period (2008-2012 average, compared to 1990 levels). In the medium-term, the country has followed European objectives, setting a target of reducing emissions by 14% (2005 base year) by 2020 in the sectors not covered by the EU Emissions Trading Scheme. Finally, since 2005 France has established the official objective of reducing greenhouse gas emissions by 75% (division by 4) by 2050 using total emissions in 1990 as the base year.

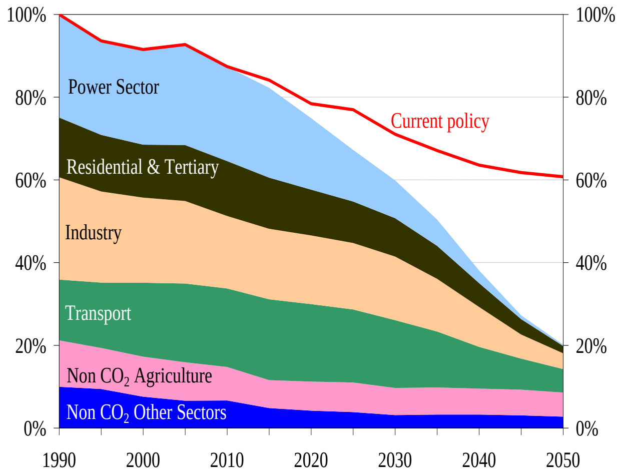
Table 1: Range of Medium and Long-Term Emission Reduction Objectives

	Reductions	Base year
International (UNFCCC)	50% reduction in emissions by 2050	1990
European Union	2020: 20 to 30% 2050: 80 to 90%	1990 1990
France	2012: 0% 2020: 14% 2050: 75%	1990 2005 1990

While these emission reduction targets are laudable and, if respected, represent substantial steps to reducing potentially catastrophic climate change, the means and the actions necessary to achieving these emission reduction objectives have still not been clearly identified. Since setting the 2050 emission objectives, a number of different studies and modeling exercises have identified pathways towards achieving emission reduction goals for the European Union and France (Table 2). Nevertheless, it remains unclear as to what reduction efforts can be expected from different sources. At the EU level, from the most recent report from the EU Commission seen in Figure 1, substantial reductions are expected from the Power Sector and Industry, which are currently covered by the EU's flagship mitigation policy, the Emission Trading Scheme. However, to date fewer policies directly target Residential & Tertiary emissions, as well as the Transport sector (EU Commission 2011). It is, nevertheless, clear that substantial efforts will be required from these sectors that have, to date, not yet significantly contributed to emission reductions. As such, at the level of the EU, recent work suggests that transport emissions could increase until 2030 (+20% to -9%) and then decrease sharply to 2050 (-54% to -67%), compared to 1990 levels (European Commission, 2011). The policy and development pathways necessary to do so, however, have yet to be identified fully.

In France, given the limited mitigation potential in the power sector due to the widespread use of nuclear energy, achieving national emission–reduction targets will depend even more on these "diffuse" sectors. In 2009, transport was the principal emitting sector in France; it was responsible for 25% of energy consumption and due to the high dependence on fossil fuels, close to 34% of national CO_2 emissions (CITEPA 2009)[2]. As such, to achieve the *Facteur 4*, 75% reduction in GHG emissions in France, substantial reductions are required from the transport sector. As seen in Table 2, scenarios typically expect a halving of base year emission levels within the sector. Often, this represents an equal or greater reduction than expected from the Residential, Tertiary and Agriculture emissions, combined – and in some instances – twice the reductions expected from industrial sources in terms of total emissions (Mathy et al. 2011).

Figure 1: Emission Reduction Scenario for 2050 in the European Union



Source: EU Commission 2011

Table 2: Sector Breakdown of Emission Reductions ($MtCO_2$) for 2050 in Relation to 2000* Base Year from the Long-Term Mitigation Scenarios in France

Scenarios	***Transports Emission Reductions 2000-2050***	***Transport Emissions in 2050***	***Transport Reduction Factor/2000 (161 in 2000)***	***Total Reductions from all sectors***	***Factor/2000***
nega Watt (2006)	109	64	**2.5**	292	4.2
MIES–F4 RconN	125	31.4	**5.1**	269	3.4
MIES–F4 *Séquest*	86	69.6	**2.3**	269	
MIES F4 Nuke	128	28.3	**5.7**	268	
MIES–F4 sN+S	91	64.8	**2.5**	267	
MIES–F4H2	105	51.4	**3.1**	266	
nega -Tep	99	57.6	**2.8**	255	3.1
Enerdata	82	76	**2.1**	249	2.9
Prevot (2030)	111	45.8	**3.5**	247	2.9
Syrota–MEDPRO	106	40.2	**4.0**	223	3
Syrota - MARKAL	85	71.3	**2.3**	199	2.9

* *It is important to note that, while 2000 is used in the base year of these scenarios, 1990 is the formal base year for the French Factor 4 commitment.*
Source: After Mathy et al. 2011

[2] This places transport well in front of Industry, representing 24% of CO_2 emissions and residential/tertiary (23%) and the power sector (16%) (CITEPA 2009).

2.2. *Achieving Reductions in the Transport Sector: from Technology Change to Demand Management*

Reducing greenhouse gas emissions in the transport sector, however, poses a significant challenge, given its historical correlation with economic growth and modern land-use patterns. Without changes in current demand for mobility and technology trends, energy use and emissions in this sector are expected to increase. A large body of research on the actions to reduce energy use and emissions in the transport sector exists, focusing on three principal strategies: technological changes, modal shifts (away from personal vehicles) and reductions in the distance travelled (reduced demand for mobility and trip speed). Between 1994 and 2008, the number of local trips per day in France increased by 4.5% with an increase between residency and the work place of 8% (INSEE 2008). As such, it is key to disconnect the growth in the number of trips, trip speed and the distance travelled in order to decrease overall demand. This must also be coupled with changes in modal distribution as well as improvements in technology (efficiency and fuels). Nevertheless, most attention has focused principally on *technological changes* as the strategic means of achieving greenhouse gas mitigation targets. The scenarios seen in Table 2 typically place an emphasis on technological developments in terms of the greenhouse gas impact of fuels along with rapid improvements in vehicle efficiency.

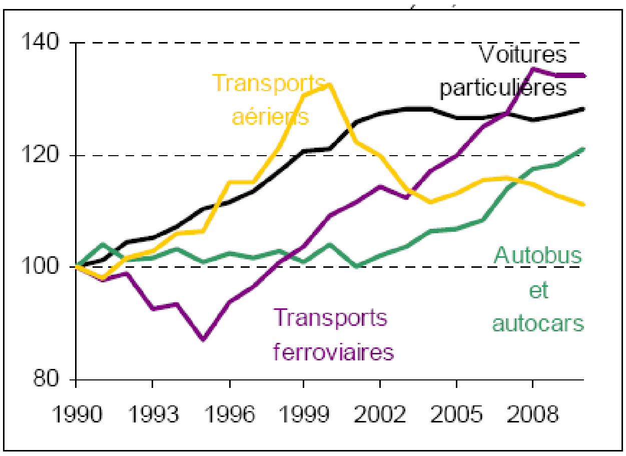
It is important to note, however, that these studies make strong assumptions concerning the market readiness, penetration and diffusion of transport technologies. Even if the most ambitious hypotheses are true concerning the rapid development and marketability of low-emissions transport technology as well as the rates of diffusion and adoption, it appears that this will only represent a 50% reduction in transport-related emissions (Lopez-Ruiz and Crozet 2010)[3]. As a number of authors have noted, the dissemination of technology must equally be accompanied by other changes in terms of organization and actions to influence behavior (Assmann & Sieber 2005; Cabal & Gaignol 2004; Scheafer et al. 2009; Sperling & Lutsey 2009). Changes in demand and distance traveled through land-use policy, public transport infrastructure, as well as the promotion of modal shifts and non-motorized forms of transport, have been estimated as crucial in achieving an additional reduction of up to 25% (Lopez-Ruiz and Crozet 2010). As such, there appears to be a clear need to understand how public policies designed to influence not only the actions needed to support the development and deployment of the technological changes touted to play such a significant role in reducing emissions, but also the demand for transport and the distance travelled.

---

[3] One of the most recent studies looking at distribution among different policies, both across sub-sectors of the transport sector as well as across policy options (technology changes vs. demand-oriented actions) is the 2010 work of Lopez-Ruiz and Crozet. Analyzing three different scenarios, this study looks at how technology and different public policies affect reductions in CO_2 emissions in the transport sector. Their work indicates that a 75% reduction in emissions from 2000 levels is possible with 50% coming from changes in technology and the remaining 25% coming from changes in demand and behavior stemming from related public policies (Lopez-Ruiz & Crozet 2010). While this appears to confirm that the majority of reductions in the transport sector are most likely to stem from changes in technology, their work equally suggests that technology alone is not likely enough to achieve the desired Factor 4, 75% reduction. These findings appear consistent with the results of the more general studies mentioned above.

The current mobility trend in France reinforces the need for action. Recent data suggests that, while the time consecrated to transport is fairly stable (one hour per day), there is still a continued increase in the total distance travelled particularly in road transport, which increased by 1.5% in 2010 (MEDDTL 2011). In terms of passenger transport alone, as seen in Figure 2, all transport modes have had a net gain since 1990 in terms of passenger-kilometers traveled with further growth expected. In addition, while other modes continue to make gains, private vehicles have and will continue to dominate the modal share, representing over 80% of passenger kilometers. Increases in road transport are responsible for a 0.8% increase in greenhouse gas emissions from the transport sector in 2010, after five consecutive years of reductions (-1.9% in 2009) (MEDDTL 2011). As such, it seems apparent that without rapid changes in transport demand, the deployment of low emission technologies, as well as changes in modal share, greenhouse gas emissions will continue to rise in the sector.

Figure 2: Domestic Passenger Transport by Mode (in Passenger-Kilometers, Index 100 in 1990)



Source: MEEDTL 2011

2.3. A Key Role for Sub-National Action?

Much research has recognized the role that local authorities play, calling for territorial planning and development to foster the changes in urban and spatial structure to support hypotheses concerning changes in demand, modal shift and technology deployment. Given the distribution of jurisdictional competencies, recognizing that issues of modal distribution and the demand for mobility must be addressed places the onus of action on sub-national authorities in France. These actors tend to hold the necessary transport and urbanism competencies and stand to influence 82% of the French population that is urbanized (Laganier & Vienne 2009). Sub-national authorities typically are key players in determining local transportation policy and influencing the spatial distribution of daily activities that are at the core of the initial demand for mobility. As such, they appear to be in strategic positions to reorganize policymaking, investment, and development choices to foster low-emission pathways. Sub-national actors equally appear to be in a position to influence and develop the acceptability of policies and actions to address greenhouse gas emissions in France by working with local populations (Manty et al. 2010; Syrota 2008:22). Local authorities appear to be able to affect the content and framing of climate policy to facilitate changes in expectations, learning, and trust among actors to take local action, rather than waiting for efforts from other levels of government or other actors. Potentially, this can occur through the linking of GHG mitigation with the larger sustainable development objectives, such as local pollution, noise, quality of life, biodiversity, urban sprawl, and economic development.

2.4. Governance Challenges and GHG Mitigation

The need for a complementary package of policies involving both technological improvements and behavioral change and demand management poses, nevertheless, a wide range of policy questions. While it is increasingly clear *what* actions should be taken to reduce emissions, the larger issue of *how* to achieve their implementation remains unaddressed. Achieving GHG mitigation requires the reduction of the overall demand for mobility, the fostering of modal shifts and the integration of GHG mitigation into decision making across levels of government through both transversal and sectoral planning documents. As such, the governance of climate change at multiple levels of government is important since barriers to the development and implementation of a GHG mitigation policy stand to reduce the global efficiency of efforts. This, in turn, poses a number of questions that must be framed within a specific institutional context: How should coordination be achieved among actors and levels of government? How should greenhouse gas mitigation be integrated into existing planning tools, such as statutory planning and strategic documents (*Schéma de Cohérence Territoriale* [SCOT], *Plan Local d'Urbanisme* [PLU], and *Plan de Déplacements Urbains* [PDU])? Further, how can quantified expertise or a *calcul* CO_2 (Syrota 2008) on greenhouse gas emissions be integrated or mainstreamed into decision making? In answering these questions, it is important to recognize that much of the capacity of sub-national governments to address these issues is dependent on the larger institutional context within which they operate and interact with other levels of government.

Given this policy context, this dissertation analyses the role within this process for local–level action and its ability to contribute to global greenhouse gas-emission reduction efforts. Framing the climate change-policy challenge as a collective–action problem, the project focuses on the multi–level institutional context for the governance of greenhouse gas mitigation. It analyses the transport sector, a significant source of global greenhouse gas emissions, while posing an interesting governance challenge involving transversal coordination both across and within levels of government as well as among different professional sectors. While there are multiple facets of the transport-mobility challenge to be analyzed (passenger vs. commercial, local vs. long distance), this project has chosen to focus on urban passenger transport. Urban transport is directly affected by both choices made at the national and local decision-making levels, subject to both transport- and urban-planning documents; it is also currently facing extensive challenges due to continued suburban development. This research uses two case studies in France, Grenoble Alpes Métropole and Nantes Métropole, both of whom have taken important steps towards integrating greenhouse gas mitigation into local decision making across policy areas over the last decade.

3. AIMS AND APPROACH OF RESEARCH

A review of the recent literature on the governance of policy subjects, such as climate change that cut across traditional sectors, levels of government and actor groups, indicates that a number of subjects are increasingly governed in a “polycentric” fashion with decision making occurring at multiple points across and among levels. As applied by Elinor Ostrom (2009), this body of theory appears to be a relevant means of analyzing the governance of climate change. Taking an interdisciplinary approach, this project draws on recent developments in collective–action theory and the common (Poteete et al. 2010; Ostrom 2009; Dietz et al 2008), theories on multi–level and polycentric governance (Ostrom 2009; Hooghs & Marks 2003) and governance tools and expertise (Cash et al. 2003; Tribbia and Moser 2008; Lascoumes & Legales 2004) to analyze what appears to be an increasingly polycentric governance approach to achieving collective action on GHG mitigation.

Placing this research within this theoretical framework, the following chapters pose the larger over-arching question of *what governance changes are needed to deliver lasting GHG emission reductions in the urban passenger transport sector?* This requires an understanding of what is necessary to facilitate the “polycentric” governance of a complex, multi-level topic requiring both national and local–level action. While substantial analysis of the individual actions needed to reduce greenhouse gas emissions has already occurred in the literature, this research focuses on the institutional context within which decision making and the integration of greenhouse gas mitigation into existing policymaking occurs.

This over-arching question can be nuanced into two inter-related questions focusing principally on the urban passenger transport sector in France:

- *How do governance challenges influence the expertise necessary to inform and drive GHG mitigation in the urban passenger transport decision-making process in France?*
- *What is necessary to produce expertise that is credible, legitimate and salient for the urban passenger transport decision-making process?*

The answers to these questions will be able to assist both researchers and practitioners in determining what expectations can realistically be held for greenhouse gas emission reduction in the urban passenger transport sector in France. Recognizing that politics will always influence policy making, this project attempts to understand how the institutional and decision-making process can be designed and how the inclusion of GHG expertise can occur in a way that ensures its long-term integration and appropriation within policy, no matter the changing political currents. As such, the principal focus of the following analysis is on understanding the institutional environment for decision making. rather than focusing on the shifting politics linked to a specific decision made.

3.1. A Qualitative Methodological Approach

The research approach of this project is based upon the principal hypothesis that *institutional context affects the capacity of local governments to manage greenhouse gas mitigation due to coordination requirements as well as information to facilitate the necessary collective action*. Testing this hypothesis requires the analysis of a number of issues in terms of what must be done to reduce emissions, who must be involved to do so, how decision making occurs and with what tools.

- *What actions are needed to reduce greenhouse gas emissions in the passenger transport sector?*
- *Who must be involved in the development and implementation of a GHG mitigation policy to achieve significant long-term emission reductions?*
- *How does the decision-making process enable or limit the integration of GHG mitigation criteria?*
- *Through what information tools can the greenhouse gas mitigation policy problem be appropriated by decision makers and implemented into the decision-making process?*

Answering these questions requires an understanding of the institutional arrangements in France as well as the identification of how greenhouse gas mitigation has been integrated to date.

This dissertation adopts a qualitative approach to explore these questions and hypothesis. The empirical analysis can be broken down into two parts. First, the following chapters investigate the institutional arrangements that structure policy making and implementation on urban passenger transport, urban planning and greenhouse gas mitigation in France. Second, in-depth case studies of two urban authorities, Grenoble Alpes Métropole and Nantes Métropole, are explored. The objective of these case studies is to collect information on the operational impacts of national institutional arrangements and understand the actions taken to integrate GHG mitigation into policymaking by two urban areas recognized for their progressive environmental policy. The decision was made to study two cases in a single national context in order to understand better how differences in practice influence outcomes within similar institutional arrangements. Furthermore, a conscious decision was made to look at urban areas other than the Paris area, given historical direct State intervention in the French capital that could distort the analysis of the impacts of institutional arrangements as well as an existing separate regulatory regime for the *Ile de France* region.

3.2. Data Collection and Analysis

The adoption of a qualitative approach also has substantial precedence in the literature on collective action and new institutional economics (Ostrom 1990, 1998, 2008, 2009; Poteete et al. 2009), the use of expertise in decision making (Lascoumes and Legales; Zittoun 2009) and the analysis of sub-national actors and metropolitan governance (Foster 1999). The qualitative approach taken in this dissertation is based on the widely adopted guidance and methods presented in the works of Robert K. Yin (2009) and John Creswell (2009). This analysis of the French institutional arrangements and the two individual case studies on specific local governments allows an understanding of the larger institutional frameworks; how different elements are factored into the decision-making process; how expertise on GHG emissions is constructed and used; and evaluate the often difficultly traced links between process, institutions and outcomes. This dissertation has also drawn on the methodological approach borrowed from ethnographic studies described as “thick description” or the use of grey literature and interview data to flesh out the context of decision making as well as the individual experiences of actors. Through the building up of layers of description, the researcher is able to identify the context, intentions and meanings, evolution of an act fixed within a text for interpretation (Thompson 2001).

Data and information used in the charting and analysis of institutional context was drawn from grey literature, national legislation, official publications and planning documents, academic papers and interview data. Research focused on those sources pertinent to understanding the institutional arrangements and decision-making contexts for urban passenger transport, urban planning and climate change in France. Summary profiles of each institutional context were written, focusing on principal legislation, planning documents, financing and actors, as well as the distribution of jurisdictional competencies for each sector. These summaries can be found in Annexes 2, 3, 4, 5 and 6.

The in-depth case studies of Grenoble Alpes Métropole and Nantes Métropole leveraged both desk research as well as semi-guided interviews with actors in each location. 20 interviews were conducted with 15 different actors at Grenoble Alpes Métropole, and 13 interviews with 15 different actors in Nantes Métropole. Furthermore, three additional interviews were conducted with actors at different levels. A list of interviewees and the length of each interview can be found in Annex 1.

The semi-guided interviews used a protocol adapted to each specific actor depending on his or her place within the policy–making and implementation process. Each interview, nevertheless, focused on three principal areas. First, a set of questions focused on the genesis, development and implementation of climate policy. Second, a second set of questions explored the linkages among transport, urbanism and climate policy, as well as the obstacles encountered. Finally, a third set of questions addressed the integration and use of GHG inventories and other information tools in decision making.

Each interview was recorded and later transcribed. This text was then imported into the HYPERresearch[4] analysis software package. Imported text was coded using 87 codes classified into 11 groups (Descriptive; General Issues; Actors, Decision Making; GHG Expertise; Multi–level governance; Climate Action Plans; Planning and Projects; Transport; Urban Planning). Reports were then exported, regrouping the different coded text across case studies and interviews by different subject groupings related to the individual research questions and hypotheses analyzed in the following chapters. This method allowed for analysis along issue-based lines independent of case studies and, thus, fostered the identification of relationships, similarities and common issues in individual departments as well as across case studies.

3.3. Limitations of the Approach Taken

While the qualitative research approach described above produces a detailed description of the institutional arrangements in France and the state of practice in the two local authorities studied, it is, nevertheless, important to recognize a number of limitations. First, as with any data–collection exercise, bias can be introduced, in this case through either false information given by interviewees or misinterpretation by the researcher. This research used the approach described above to overcome this potential limitation through the

[4] HYPERresearch is a code-and-retrieve data–analysis software for qualitative analysis designed to aid in any project involving analysis of qualitative data. http://www.researchware.com/products/hyperresearch.html

identification of common trends rather than basing analysis on anecdotal information from a single source or case. As such, transcript text on similar issues was coded and extracted independent of individual case studies and local government departments. However, given the relatively small sample size due to the time-consuming nature of the approach taken, further case studies are necessary to confirm the wide-spread applicability of the conclusions presented in this dissertation.

Second, as with any case-study-based research approach, it is important to recognize that, while this method can indicate a number of lessons that function well in a given context, it is difficult to draw conclusions concerning best practice in general. As such, it is important that the analysis and results presented in the following chapters be not misconstrued as representative of the state of practice throughout France. The two urban authorities selected for study appear to be among the most advanced in the development of their transport and urbanism policy in France and, thus, may not face similar problems than authorities may face in address GHG mitigation in these sectors when existing policies are equally under-developed.

3.4. Contribution to Broader Literatures: Theory and Practice

This dissertation contributes to the larger theoretical literature on collective action and the governance of environmental subjects as well as the more applied policy literature on sub-national climate action.

First, the chapters below apply and test a number of theories on multi–level government, robust environmental governance and the application of a modified theory of collective action to achieving greenhouse gas mitigation. These theories have often been explored with other environmental subjects and in different institutional contexts, but may not yet have been applied to a transversal issue such as climate change requiring action by a broad spectrum of actors across multiple levels of governance. While this research does not revolutionize the ideas presented in the existing literature, it does, however, demonstrate that a number of the elements that have been identified as vital are equally applicable to, and are increasingly visible in, the governance of GHG emissions.

Second, the following chapters analyze a number of issues relevant to applied policy literature on sub-national climate action. Internationally, the role of a local level in combating climate change is increasingly being recognized by national governments. Internationally, there is an increasing recognition that nations will not be able to meet their mitigation objectives without leveraging the competencies of local-level governments. Furthermore, beyond an analysis of individual mitigation actions, there has been little analysis of the institutional context to foster mitigation. To date, this involves the development of not only climate action plans (addressed in Chapter 4), but also a new policy indicator and information tools to link individual actions to greenhouse gas emissions. This dissertation examines the multiple uses of this information in governance processes (climate action plans, sectoral mainstreaming, project evaluation). This analysis is timely, given that different quantified and qualitative information tools are gaining traction and momentum both in France and worldwide.

Finally, this dissertation has an inherent value in its description of the French context that is often not available, first in English, and second in a multi-level fashion spanning levels of government. As such, the below "thick description" of the French institutional context and governance practices aims to contribute to larger international literature and foster further comparative research.

4. OVERVIEW OF SECTIONS AND CHAPTERS

Focusing on the specific case of urban passenger transport and basing the analysis within the French institutional context, the three sections of this dissertation build on one another to explore the governance challenge. Based on two cases studies, that of Grenoble Alpes Métropole and Nantes Métropole, lessons have been drawn on the barriers to achieving collective action, as well as the different solutions that have been developed to date. Section 1 explores the polycentric governance of greenhouse gas mitigation, presenting both a theoretical framework for analysis while looking at the complementary nature of local policies to national-level actions. Section 2 analyses the specificities of the French institutional context for transport, urbanism and climate policy. It identifies both the potential barriers to GHG mitigation as well as the solutions, such as Climate Action Plans, that have been developed to coordinate action to date. Section 3 explores in detail the role of information tools in the mainstreaming of GHG mitigation directly into urban transport decision making, touching on the saliency, credibility and legitimacy of the needed expertise.

4.1. Section 1–Collective Action and Sub-National GHG Mitigation Policy

Addressing the greenhouse gas mitigation policy problem requires not only an understanding of the different policy actions needed to reduce emissions, but also the governance relations to ensure their contextualized development and implementation. Drawing on the theoretical literature, Chapter 1 *On the Commons and Climate Change* explores the characterization of greenhouse gas mitigation as a collective–action problem requiring action at multiple levels of governance. This review of the literature pulls from Elinor Ostrom's modified theory of collective action to understand how building reciprocity and trust among actors is fundamental to the effective management of GHG emissions within a multi-level, and often polycentric, context (Ostrom 2009; Poteete et al. 2010). Second, the chapter explores the governance processes identified as necessary in the literature, drawing on Dietz et al.'s (2008) framework for environmental governance and Cash and Moser's work (2008) on information and expertise for decision making. Chapter 2, *Beyond Pricing Carbon: Increasing the Efficiency of Greenhouse Gas Mitigation through Local Policies - The Case of Urban Passenger Transport* analyses the role of local-level action in relation to national policies principally focused on introducing a price on carbon and regulation targeting energy efficiency. Identifying and making the case for the necessity of complementary actions in the urban passenger transport sector, the chapter equally explores their "polycentric" distribution of action across different levels of government.

4.2. Section 2–Local Action and Institutional Context in the Polycentric Governance of Climate Change

Section 2 builds on the theory and identification of policy actions and roles identified in Section 1, contextualizing the analysis within the specific institutional context in France. Chapter 3, *Action constrained by context: institutional arrangements and GHG mitigation in the urban passenger transport sector*, analyses the institutional context for urban passenger transport and urban planning in France. Understanding the fragmentation of jurisdictional competencies both across and within levels of government, as well as the limitations on the different resources needed for governance (expertise, capacity, finance), allows the identification of the institutional barriers to greenhouse gas mitigation within this sector. Given the necessity of fostering coordination between and across policy sectors and levels of governance, the chapter identifies lessons from institutional solutions already being developed by Grenoble Alpes Métropole and Nantes Métropole to overcome these barriers. Chapter 4 *Coordinating GHG Mitigation: Climate Action Plans and GHG Inventories in France* outlines the larger climate policy framework developed in France to date. The analysis focuses specifically on the Climate Action Plan, the principal method of coordination deployed at the local level to manage climate change. Drawing on the experiences of two French case studies, the chapter analyses how the climate action plans are structured institutionally and the different tools (coordination, information) to facilitate collective action around greenhouse gas mitigation.

4.3. Section 3–Measuring for Mitigation: Information Tools, Greenhouse Gas Emissions and Urban Passenger Transport in France

Recognizing the importance of information tools (greenhouse gas inventories, projections, impact studies) as parts of the governance process, Section 3 analyses their credibility, legitimacy and saliency for decision making. Recognizing that sectoral integration of GHG mitigation is necessary in addition to the larger climate action–plan dynamic, Chapter 5 *Mainstreaming of GHG mitigation into urban passenger transport planning: lessons on saliency from two French case studies* looks at this “mainstreaming” of GHG information tools and decision-making criteria into the transport decision-making in France. Focusing on the *Plan de déplacements urbains*, this chapter explores the decision-making process as well as the individual information tools used to date. The analysis identifies procedural barriers as along with current limits of the saliency of expertise for policy making. Finally, identifying a nascent hierarchy or “information system” of GHG quantification tools operating at multiple levels, Chapter 6 *Towards a Hierarchy of GHG Information Tools: Implications for Harmonization, Production and Appropriation* explores the conditions for their production and development. Taking up questions of how not to only ensure their technical credibility and their legitimacy in the decision-making process, the chapter looks at an increasing need for basic methodological harmonization as well as the roles of long-term technical partnerships and co-construction in the production of expertise.

SECTION ONE:
COLLECTIVE ACTION AND SUB-NATIONAL GHG MITIGATION POLICY

CHAPTER I:
ON THE COMMONS AND CLIMATE CHANGE

"I would rather address the question of how to enhance the capabilities of those involved to change the constraining rules of the game to lead to outcomes other than remorseless tragedies."

Elinor Ostrom 1990:7

1. INTRODUCTION

Reducing greenhouse-gas (GHG) emissions from anthropogenic activity may be one of the greatest collective-action problems faced by humanity. As such, greenhouse-gas mitigation poses a complex policy challenge spanning traditional jurisdictional and sectoral boundaries as well as across time. The reduction of greenhouse gases alone in a single location rarely leads to directly detectable and immediate effects that individual actors can observe or appreciate, given that benefits accrue globally with longtime horizons. As such, GHG mitigation requires significant coordination of actors both between and across levels of government. Often, the only indicator of change are abstract emission-reduction totals and inventories difficult to take into consideration both in terms of making day-to-day decisions or tackling related policy subjects for decision makers. As such, reducing greenhouse-gas emissions will require coherent, coordinated policy decisions across and between levels of governance. This will most likely require the participation of not only elected officials, but also equally the public and private actors involved in sectoral activities. This poses challenges not only in terms of the institutional configurations to support coordinated governance processes, but equally the information tools and expertise necessary to link GHG mitigation with other policy priorities. This chapter draws lessons for the governance of climate change and specifically GHG mitigation from the theoretical literature surrounding the management of the '*Commons'* [5] and collective action that serve as the theoretical basis for this dissertation. Given the increasingly recognized necessity to take action at multiple levels of governance – from international to local- this paper will focus specifically on the institutional arrangements and the informational tools necessary to create a context necessary to foster what Elinor Ostrom has termed a 'polycentric approach for coping with climate change' (2009).

1.1. The Climate Change Policy Challenge

There are three distinct aspects of the climate-change policy challenge that often renders efficient[6] mitigation action difficult. Principally, climate change poses complex intra-

[5] *Commons* typically refers to resources that are owned in common or shared between or among communities. These resources are said to be "held in common" and can include everything from natural resources and land to software. The *Commons* is also a way to refer to the larger body of literature treating the governance of these resources

[6] The author uses a working definition of efficient action as that which achieves real, long-term GHG emission reductions at relatively low-cost.

and inter-generational equity problems. First, due to the global nature of the greenhouse effect and the trans-boundary impacts of greenhouse-gases emissions, action on climate change must be coordinated globally with all major GHG emitters participating in the reduction of current and future emissions. This poses significant challenges in terms of coordinating action across nations, heterogeneous in terms of wealth, level of development and current per-capita emission profiles (Newell 2000, Fischer 2004). As such, an intra-generational problem is posed as to what can be expected from different actor groups given their responsibility for emissions as well as the impacts that they will bear. Further, action on climate change is complicated by the need to reduce greenhouse-gas emissions to reduce the severity of climate change while at the same time preparing and implementing the appropriate policies to adapt to both potential and inevitable climatic impacts (Corfee-Morlot et al. 2010). While GHG mitigation and adaptation policy are complementary and must occur in tandem, both require the justification of present costs for uncertain future benefits. Second, climate change poses an inter-generational challenge as choices made today concerning energy generation, transportation, land-use and other activities will influence greenhouse-gas emissions for decades to come. This inter-generational aspect also influences the distribution of costs and benefits that often renders traditional policy-making methods and approaches ineffectual in the choice and implementation of mitigation policies due to present costs for future, often distant and difficult to calculate, benefits (Corfee-Morlot et al. 2010; Corfee-Morlot 2009).

Further, climate change is a cross-cutting problem, calling into question many of the basic social and economic processes, ranging from energy production and food supply, to industrial activity, transportation, etc. Effective action must take a holistic approach, breaching the issue-based “silos” surrounding many of these traditionally insular policy sectors (Corfee-Morlot et al. 2009). A range of actions is often needed that treat multiple facets of the problem at once. This is intimately linked to the fact that in many cases reducing greenhouse-gas emissions will require widespread behavioral change, in terms of both technologies as well as methods of production and consumption.

Climate change in many ways presents a “classic” collective action problem resulting from a mismatch of incentives in terms of costs and benefits both across locations and across time. Actors and individuals lack the incentive to take part in collective action as it is possible to ‘free-ride’ on the efforts of others as the benefits of reducing greenhouse-gas emissions can be classified as those from a public good and thus accessible to all. As such, classical, rational-actor theories of collective action would suggest that the participation of individual actors would remain minimal and that action would be focused at the international level where the entirety of costs and benefits can be integrated (Legget 2009). However, this is often contradicted by observations in reality: action has been taken at multiple levels of government by both the public and private sectors. While, as expected, much official policy making is concentrated on international coordination of GHG-mitigation action, the scope for sub-national greenhouse-gas mitigation action is becoming increasingly visible. Whether this stems from dissatisfaction of the slow nature of international action or from local pressure to take up the subject, it suggests that sub-national collective action on the subject is possible and potentially powerful.

Finally, mitigating future changes in climate requires an understanding of how past, current and planned actions impact greenhouse-gas emissions, and thus the severity of change. Emissions of the six greenhouse-gas emissions recognized by the United Nations Framework Convention on Climate Change (UNFCCC)[7] are typically in and of themselves intangible and often go unnoticed unless accompanied by other negative (or positive) effects. Further, as mentioned above, the impact of present-day emissions is not immediate in a single locality (in terms of both time and geographic location). As such, it is necessary to devise and construct means of calculating, monitoring and evaluating not only the sources of greenhouse-gas emissions, but also the direct and indirect impacts of individual actions taken to reduce them. Thus, the development of different forms of expertise, as well as their integration or "mainstreaming" into decision-making, policy implementation and evaluation, must be given careful attention.

This chapter reviews the current literature on the "*Commons"* to understand what recent development in theories of collective action can be used to understand better the governance of GHG mitigation in terms of the role of actions across levels of government and the need for specialized expertise and information. Drawing on recent literature, Section 2 explores the noted transition from a theory of collective action based on the assumed rationality of actors to one building on a behavioral theory of the individual. Lessons from decades of research on the collective management of common pool resources that can be applied to the climate-change policy challenge are identified. Section 3 looks at recent developments in how institutional context across levels of government influences the context within which collective action occurs at the local level. Finally, Section 4 reviews recent literature on the role of information and expertise for policy and decision-making, its use, and its production.

2. THE COMMONS AND COMMON POOL RESOURCES

The literature on the Commons draws from a wide range of disciplines and traditions, focusing on the management of things held in 'common' - typically focusing on natural resources, although it has equally been applied to other types of goods and services. While most non-renewable resources have been privatized, renewable resources are often held in common or public ownership (Stavins 2010). The objective of much of the reflection surrounding the Commons has focused on how to achieve the collective action necessary to ensure the sustainable, productive use of these resource systems (Stavins 2010; Ostrom 1990, 1998, 2009; Poteete et al. 2010). Much of the research on the Commons focuses on 'Common Pool Resource,' or "… a natural or man-made resource system that is sufficiently large as to make it costly (but not impossible) to exclude potential beneficiaries from obtaining benefits from its use" (Ostrom 1990:30). The challenge of the Commons stems principally from situations where users do not bear the full consequences (social costs) of their actions and thus

[7] The six UNFCCC recognized greenhouse gases are: carbon dioxide (CO_2); methane (CH_4); nitrous oxide (N_2O); hydrofluorocarbons (HFCs); perfluorocarbons (PFCs); and sulphur hexafluoride (SF_6). The United Nations Framework Convention on Climate Change (UNFCCC or FCCC) is an international environmental treaty signed in 1992. Its objective is to stabilize greenhouse-gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system.

over-exploit resources without investment in their long-term management (Olson 1965; Hardin 1968; Ostrom 1990, 1998, 2009; Libecap 2008; Poteete et al. 2010).

Two overlapping categories of common pool resources are primarily treated in the literature. First, *common property resources* (extensively treated by Elinor Ostrom) are those resources that are collectively owned or held either by a group or that are public property[8], including fisheries, grazing land, small-scale aquifers, etc. While access may be limited to members of the group, consumption may be non-excludable within the group. Second, '*open access common pool resources'* are those to which no party claims exclusive ownership, such as ocean fisheries, as well as the global atmosphere as a sink for pollutants. These resources tend to be much larger in size, crossing traditional administrative and jurisdictional boundaries; often the costs of developing restrictive boundaries are higher than the apparent historically perceived benefits (Libecap 2008:552). Both categories of common pool resources have two dimensions: first, the management of the *flow* of resources, or the contemporaneous use of the *units* produced by the resource system (fish, trees, liters, metric tons of emissions, etc.). The second dimension concerns the management of *stocks* or the total number of limited units or the capacity of the system to regenerate each year. Often, over-consumption of the resource *flows* can negatively impact the ability of the *stock* to regenerate over time and continue to produce sustainable yields.

2.1. Greenhouse-gas emissions as the use of a Common Pool Resource

While typically not viewed as a natural resource in and of themselves, issues of environmental degradation can be structured as *common pool resource problems* when the global environment is understood as a sink for pollutants (fluvial, atmospheric, etc.). Climate change and the emissions of the six UNFCCC-recognized greenhouse gases is no exception. In this case, the atmosphere is considered as a sink able to stock only a certain flow[9] of greenhouse-gas emissions before resulting in an increase in the global mean temperature. When the flows into the atmosphere outpaces the sequestration of emissions, only so many units of greenhouse gases can be emitted before the defined limit of sustainable use has been attained. Given that greenhouse-gas emissions remain in the atmosphere for an extended period of time (from decades to centuries), management efforts are focused principally on the *flow* of greenhouse-gas emissions that can yet be emitted. As such, much research and international efforts have attempted to identify the quantity (measure in parts per million) of greenhouse gases that the atmosphere can hold in order to achieve the target of limiting the increase of mean global temperature by 2°C before the end of the century.[10]

Further, climate change can be classified as an *open-access common pool resource problem*. As with other environmental and air-pollution problems, the emissions from

[8] Public property is a form of common property owned by all the citizens, but typically controlled by elected officials or bureaucrats, who determine the parameters for access and use (Kondoh 2009).

[9] The carbon cycle is the biogeochemical cycle by which carbon is exchanged among the biosphere, pedosphere, geosphere, hydrosphere, and atmosphere of the Earth.

[10] This target, adopted by negotiating parties at the 2010 COP/MOP in Cancun, Mexico, requires that the concentration of GHG emissions in CO2-equivalent remain below 450 parts per million. Currently, that atmosphere is already estimated to have passed 385 ppm (NOAA 2008).

different source of pollution are spread across a large area, thus distributing the costs of pollution and lessening the direct negative impacts on the polluter. This is equally true in terms of the distribution of benefits from measures taken to reduce pollutants at their source: the majority of the cost is borne by the polluter while the benefits of emission reductions are distributed across a broader area. Therein lays the source of the collective-action problem stemming from a mismatch of incentives, given that the costs and the benefits of reducing emissions are borne by different actors. This problem, often the heart of the Commons literature, will be explored in the following sections as well as the different solutions that have been proposed to achieve collective action. Further, given that greenhouse-gas emissions tend to aggregate homogenously in the atmosphere across geo-political boundaries, theory thus suggests that international, if not global, cooperation is the proper level at which attention should be focused (Stavins 2010; Stern et al. 2006).

2.2. The Theory Collective Action and the Tragedy of the Commons

At the heart of the debate surrounding collective action is how to avoid inaction and free riding in the management of public goods. Much of the conventional theory of collective action is based on the work of Mancur Olson (1965) and Garret Hardin (1968). Through his work, Olson laid the foundation for much of the modern theory by challenging the then-widely accepted idea that the benefits derived by a group would be sufficient to overcome the temptation for an individual not to contribute to a good benefitting the entire collective.

> …unless the number of individuals is quite small, or unless there is coercion or some other special device to make individuals act in their common interest, rational self-interested individuals will not act to achieve their common or group interests (Olson 1965:2)

With what has become known as the *zero-contribution hypothesis*, Olson injected into the debate the idea that without means of excluding an individual from the collective benefit, there is little incentive for a person to contribute to its production.

Garret Hardin and his contemporaries subsequently applied the theory of collective action as presented above to the Commons.

> Picture a pasture open to all... A rational herdsman concludes that the only sensible course for him to pursue is to add another animal to his herd. And another; and another... Each man is locked into a system that compels him to increase his herd without limit — in a world that is limited. Ruin is the destination toward which all men rush, each pursuing his own best interest in a society that believes in the freedom of the commons. Freedom in the commons brings ruin to all (Hardin 1968:1244).

Hardin’s now famous ‘tragedy of the commons’ presents a context within which each actor acts in an economically-rational fashion to maximize his utilization of the unregulated common pool resource. An individual receives the full benefit of consuming one more unit of the resource, and shoulders only a fraction of the shared cost spread throughout the entire group. As such, all individuals would maximize short-term benefits and would be highly unlikely to cooperate spontaneously.

Based on the conventional theory of collective action, solutions to the problems plaguing the Commons focus principally on the intervention of an external actor (the State or other) to institute equilibrium and/or take control of the common pool resource (Hardin 1968, Ostrom 1990). In general, two broad categories of solutions that in theory achieve the same results, but through different means are often evoked. As advocated by Hardin, a 'Leviathan' or an external force capable of punishing misbehavior must take control of the resource to ensure its proper use. This external force is able to set the rules and enforce them, in theory ensuring that the full costs and benefits are shared by all parties.

The second approach involves the privatization of the resources, either to the benefit of a single party or by splitting it into units and dividing it among the different actors. As such, in theory and given that the system can be divided in a homogenous fashion, each actor would then bear both the costs and the benefits of his individual actions. In both of these cases, an external force is typically necessary to implement the solutions to the collective-action problem, rather than coming from the individual stakeholders themselves. Thus, there is the potential for action without any real form of the 'collective' (i.e. effected stakeholders) involved. However, as explored further below, the enforcement and monitoring costs required to assure the effectiveness of an external agent may be relatively high without the active participation of stakeholders.

As indicated by a number of authors (Stavins 2010; Ostrom 2009), the conventional theory of collective action can be applied to the problem of reducing global greenhouse-gas emissions. Climate change is caused by billions of individual actors, each emitting greenhouse gases. Each actor stands to bear a portion of the direct cost stemming from a change in daily socio-economic behavior required to reduce his emissions. Equally, each actor will only indirectly benefit from the shared good of avoiding increases in average global temperature due to temporal and geographical distribution of benefits. Applying Olson's zero contribution hypothesis and Hardin's tragedy of the commons results in the hypothesis that no spontaneous action to limit the use of the atmosphere as a GHG sink would occur. As such, an external authority must necessarily impose and enforce policies at the scale of the externalities (in this case, the planet), without which there would be little incentive to act (Ostrom 2009). Therefore, policies of international scope have received the most attention in the climate-change discussions (Stavins 1997, 2010; Wiener, 2007) as they seem best suited to do this.

2.3. From a rational choice theory to a behavioral theory of the individual

There has, however, been substantial critique of the conventional theory of collective action, focusing particularly on the assumptions made by Olson, Hardin and others concerning individual behavior. "These models [from Olson and Hardin] are extremely useful for explaining how perfectly rational individuals can produce, under some circumstance, outcomes that are not 'rational' when viewed from the perspective of all those involved" (Ostrom 1990:6). However, Elinor Ostrom, one of the foremost critiques of this conventional view, notes that the zero-contribution hypotheses is often contradicted by what is seen in daily common pool resource management situations (1990, 1998, 2000; Poteete et al. 2010). In her work, she has determined that there is not one type of individual, but many, within different levels of willingness to cooperate (Ostrom 2000). Further, Ostrom and others have repeatedly detailed and analyzed cases where neither privatization nor state intervention has been necessary to allow for the sustainable management of common pool resources, thus calling into question Hardin's tragedy (Dietz et al. 2009; Ostrom 1990, 1998, 2000, 2009; Poteete et al. 2010). While the conventional theory of collective action may be applicable in cases where its strong assumptions holds true, empirical research indicates that collective action is possible (Ostrom 1990, 1998, 2000; Poteete et al. 2010). To understand this better, Ostrom and others have challenged a number of the assumptions surrounding the conventional theory of collective action.

This critique of the conventional theory of collective action can be roughly situated in the New Institutional Economics tradition stemming back to Ronald Coase. While traditional theories of collective action analyze individual actions and behavior, they often fail to consider the larger institutional context behind the need for external intervention. As experience from research demonstrates, even well-planned external intervention can in some cases fail to solve the collective action problem (Dietz et al. 2009; Ostrom 1990, 1998, 2000, 2009; Poteete et al. 2010)[11]. The New Institutional Economic (NIE) theory approach challenges a number of the assumptions made by neoclassical economics and stems from the seminal work of Coase (1937, 1960) emphasizing the role of institutional arrangements in economic governance. The principal argument of this theory revolves around the idea that individuals can capture gains from trade by cooperating. However as cooperation is costly and harmed by opportunism, it is necessary to develop "institutions" or formalized interactions to overcome these problems (Gagliardi 2008). While adopting many of the principal neoclassical tenants (rationality [if bounded] of actors[12], etc.) this strand of theory treats environmental degradation in terms of *interdependencies* between actors rather than unassigned externalities and recognizes the effects of *transaction costs*. Given that different institutional configurations can introduce differing levels of transaction costs, institutional arrangements can thus influence the overall efficiency of policies. NIE theory acknowledges positive transaction costs (Coase 1937, 1960) and how institutional arrangements influence economic outcomes when they are taken into consideration (North 1990).

The conventional theory of collective action based on the work of Olson and Hardin relies on rational choice theory to characterize individual behavior. As such, individuals are theorized to be self-interested "maximizers," who in one-shot or finitely repeated contexts were unlikely to cooperate when payoff structures brought more immediate gains from self-interested action. Ostrom admits that "[p]redictions from this theory are well supported when applied to the analysis of the provision and production of private goods in a highly competitive environment" (Ostrom 2009:10). In these cases, a highly competitive and dynamic market is able to screen out those actors that do not maximize the cost-benefit ratio. However, it is difficult to explain observed examples of collective action in the management of common pool resources with rational choice theory (Ostrom 1990, 1998, 2000, 2009; Poteete et al. 2010). Rational choice theory assumes that all individuals will have perfect

[11] Much of Ostrom's work is focused on the management of fisheries as well as pasture and other common pool resources.
[12] The analysis presented in this chapter adopts the idea of the bounded rationality of actors, meaning that decision making occurs under incomplete information due to the high costs of information and that cognitive processing ability is limited.

information concerning the full range of costs and benefits concerning every choice. Thus, in the conventional theory of collective action, individuals are assumed to have complete information "…about the structure of the situation they are in, including the preferences of other actors, the full range of possible actions, and the probability associated with each outcome resulting from a combination of actions" (Poteete et al. 2010:217). As such, collective action is reduced to a simple prisoner's dilemma with little expected spontaneous cooperation, even when repeated.

However, contrary to what rational choice theory predicts, the collective local management of common pool resources has been repeatedly documented (see Dietz et al. 2008; Ostrom 1990, 1998, 2000, 2009; Poteete et al. 2010 for both examples as well as exhaustive bibliographies on the subject). To fit better what they have found through empirical research and through different theories of bounded rationality[13], Ostrom and her colleagues posit that additional models are necessary to describe individual behavior:

> Explanations can no longer rest entirely on the model of the individual facing a particular type of payoff function. Instead…an explanation of cooperation must be based on individual learning and norm-adoption, as well as the influence of micro-situational and broader contextual variables, in generating variable levels of cooperation. (Poteete et al. 2010:220)

As such, a number of researchers have turned towards the development of a *behavioral theory of the individual* to predict better the reciprocal behavior identified between actors, which – to date – has been unexplainable by conventional theories of collective action (Ostrom 1990, 1998, 2009; Poteete et al. 2010)[14]. Within this approach, collective exchanges are a process of developing trust, reputation and reciprocity rather than as single-shot or finite prisoner's dilemma (Ostrom 1998). Instead of relying on external "hard" enforcement of regulations and laws to achieve objectives, this approach focuses on the development of an institutional context to foster "soft" methods to increase levels of cooperation.

A behavioral theory of the individual views individuals as adaptive rather than purely rational creatures "…who attempt to do well given the constraints and opportunities of the situations in which they find themselves (or the ones that they seek out)" (Poteete 2010:222), thus learning from one-another as how to do so. This theory for understanding individual behavior is based on three core assumptions:

1. **Actors possess incomplete information** about the structure of the situation in which they are interacting with others, but they may acquire more complete and reliable information

[13] New Institutional Economics has often sided with the neoclassical economic theory concerning the rationality of actors; however, a number of authors question this tenant and, rather, advocate the use of 'bounded rationality' (Williamson 1981; Tversky and Kahneman 1974; Ostrom 1998, 2009). While a full review is beyond the scope of this paper, a bounded approach recognizes that the rationality of individuals tends to be limited by their access to information, their cognitive capacities to accept and process new information and the finite amount of time they have to make decisions. Further, it is also accepted that actors often organize their spending into separate mental "accounts" for food, housing, entertainment, general expenses and so on; thus, their logic for each budget line can differ (Kahneman and Tversky, 1974).

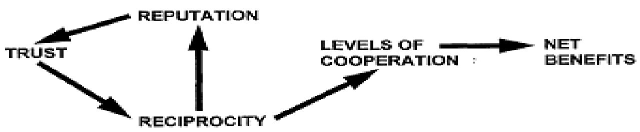
[14] Many of the empirical observations upon which Ostrom and her colleagues base their work come from both the analysis of case studies of existing common pool resources management as well as game-theory lab exercises based on their findings. For a complete overview of the game theoretical foundation for her critique of the conventional theory of collective action, beyond the scope of this paper, see Ostrom 1990 Chapter 1.

over time, especially in situations that are frequently repeated and generate reliable feedback to those involved.

2. **Actors have preferences related to achieving** net benefits for self, but these are combined in many situations with others regarding **preferences and norms about** appropriate actions and outcomes that affect their decisions.
3. **Actors use a variety of heuristics in** making daily decisions that may approximate maximization of net benefits (for self and others) in some competitive situations but are highly cooperative in other situations. (Poteete et al. 2010:223)

As such, instead of focusing on the individual, this approach focuses on the contextual or institutional factors involved to understand the behavior of individual actors and actor groups. Given a certain context, Ostrom and her colleagues hypothesize that individuals "try to solve problems as effectively as they can" (Ostrom 1990:25). This does not necessarily mean that individuals do not seek benefits for themselves, but, rather, that there are variations in their preferences regarding other individuals and that are sensitive to normative signals and values concerning what is appropriate behavior in certain settings (Ostrom 2009). This circulates around their capability to gain a reputation of trustworthiness, often leading to the reciprocation of efforts from and by others, leading to potential high levels of cooperation (Poteete et al. 2010). As seen in Figure 3, the development of reciprocity, reputation and trust between actors is an iterative process that directly influences the levels of cooperation and, thus, the net benefits derived through collective action.

Figure 3: Core Relationships in a Modified Theory of Collective Action



Source: Ostrom 1998

Adopting a modified theory of collective action based on a behavioral theory of the individual significantly changes the resulting analysis. Instead of attempting to understand what policy tool is necessary to impose sustainable use of common pool resources from the exterior, it is rather more telling to develop a context within which collective action becomes possible. Success is no longer solely tied to incentives, but equally to the provision of information, learning, and interaction among stakeholders. Implicitly, an analysis and understanding of the associated transaction costs is necessary following the new institutional tradition (Coase 1960, Hall 1993, North 1990, Ostrom 1990, Williamson 1998). The policy 'metaphors', as Ostrom has termed the prescriptions of using the leviathan and privatization to solve all collective action problems, are no longer uniformly applicable as a broader range of contextual variables must be taken into consideration.

> To achieve its objectives, any policy that tries to improve levels of collective action to overcome social dilemmas must enhance the level of trust by participants that others are complying with the policy or else many will seek ways of avoiding compliance" (Ostrom 2009:11).

While the risk of free riding must still be dealt with, it is the structure of the larger context within which the collective action problem is managed that must be understood.

2.4. *Application to a global open-access common pool resource problem: the importance of co-benefits and transaction costs*

Can a case be made for treating what has traditionally been framed as an open-access common-pool resource - i.e. the atmosphere as a global sink of greenhouse-gas emissions - as a common-property common-pool resource upon which the management of Poteete and Ostrom's modified theory of collective action is based? This, implicitly, requires that different actor groups accept responsibility for their portion of emissions generated by global economic activity. While both international and national action is important to establish the larger framework for action, this question hinges on the ability of greenhouse-gas emissions to be seen as a local concern once internationally accepted emission-reduction targets have been established. Even with a modified theory of collective action, it would appear that if costs remain local and benefits are global in nature, little incentive exists to act locally. As such, any external mandate to reduce emissions would require extensive compliance-control measures to reduce and limit free-riding (hard enforcement). Furthermore, individual actors and groups face significant information asymmetries and costs concerning the necessary information to link their actions with emissions. Applying the modified theory of collective action, however, requires a number of assumptions to be challenged: (1) that benefits are only global in nature; (2) transaction costs do not affect cooperation, and (3) the focus on action at the national and international level.

2.4.1. Co-benefits

Increasingly, researchers suggest that the double dividends, or the co-benefits, of climate policies can be used to anchor climate policies in a given location (Ostrom 2009; Bollen et al. 2010; Krupnick et al. 2000; OECD 1999; Corfee-Morlot et al. 2009; Corfee-Morlot et al. 2010). In many cases, synergies exist between explicit GHG-mitigation actions and other policies that have indirect impacts on emission levels. For example, many authors have noted that pursuing greenhouse-gas-emission mitigation policies will potentially have significant impacts on local air pollution (see Bollen et al. 2010 for a review of quantified studies). As such, in a scenario where GHG emissions are cut by 50% relative to 2005 levels in 2050, there is a 20 to 40% reduction in the number of premature deaths relative to a Business – as – Usual (BAU) scenario (Bollen et al. 2010:6). Not only can climate policies have local co-benefits, these co-benefits stand to shift the near-term relevancy and 'temporal' nature of the climate-change policy debate. While benefits from GHG mitigation will be most felt in the future and in areas geographically distant from where reductions occur, most co-benefits are experienced in the short to mid-term (Krupnick et al. 2000; Bollen et al 2010). Inversely, what must not be forgotten is that given the priorities of local authorities, GHG mitigation may be seen as a co-benefit of a more 'pressing' policy objective, such as reduction of congestion, local air pollution, urban sprawl, etc. (Corfee-Morlot et al. 2009; Betsill 2001; Betsill and Bulkeley 2004). This often-positive (although not exclusive) synergy between mitigation and local policies and objectives may serve as a foundation for local-scale action (Ostrom 2009:11).

2.4.2. Transaction costs

Stemming from the seminal work of Coase (1937, 1960) who emphasized the role of institutional arrangements in economic governance, the New Institutional Economic (NIE) theory approach challenges a number of the assumptions made by neoclassical economics. Transaction costs are traditionally defined as the costs of conducting negotiations, seeking information, developing contracts, and monitoring and enforcing compliance (Dhalman, 1979; Barzel, 1985) both from market and non-market transactions. These costs often emerge from the difficulty of obtaining and processing information and, in many instances, can be used to explain why institutions exist in the first place. Given that institutional configurations can introduce differing levels of transaction costs, institutional arrangements can thus influence the overall efficiency of policies (Coase 1960, Hall 1993, North 1990, Ostrom 1990, Williamson 1998).

2.5. A case for sub-national action

It is equally important to challenge the assumption that the international scale or the national scale is the most appropriate for action due to the scope of the issue in question and the ability to internalize all costs and benefits. Taking transaction costs into consideration appears to strengthen the case for complementary sub-national action. First, a number of authors have indicated that waiting for an international agreement to produce a comprehensive plan of action through a process based on unanimity (and thus implying substantial transaction costs related to negotiation, etc.) is in and of itself unrealistic (Fischer 2004; Ostrom 2009; Corfee-Morlot et al. 2009). While international action is critical, given the often-slow process currently in place and the associated transaction costs of negotiation, decentralized action often appears not only feasible, but also potentially necessary[15]. Second, even when international and national action has been engaged, this does not necessarily mean that all barriers to GHG mitigation are removed. As Ostrom notes:

> Before making a commitment that the global level is the only scale on which to address climate change, one should at least reflect on past efforts to adopt uniform policies by very large entities, efforts intended to correct for problems of collective action. The presumption that locals cannot take care of public sector problems has led to diverse policies to place responsibility for local public services on units of government that are very large, frequently lacking the resources to carry out their assignments, and overwhelmed with what they are assigned to do. (2009:22)

For example, the informational costs related to the centralization of a policy subject such as urban planning are high due to the need for contextualized solutions to problems. In the case of reducing urban passenger transport emissions (explored in subsequent chapters), this further complicates the implementations of mitigation policies that rely heavily on behavioral changes at the individual level in terms of daily activity. It is important to note that a wide range of policy subjects that can directly influence greenhouse-gas emissions are held at the local level and are able to directly influence individual behavior (ARUP 2011; Corfee-Morlot et al. 2010; Corfee-Morlot et al. 2009; World Bank 2010; Betsill 2001; Bulkeley and Kern

[15] For example, international negotiations through the United Nations Framework Convention on Climate Change are consensus-based and have, thus, often been blocked by a small number of nations.

2006; Sippel and Jenssen 2010). As such, it appears that the institutional configurations and the distribution of competencies across levels of government can influence the governance of GHG mitigation.

As the above section indicates, greenhouse-gas mitigation can be seen as a collective-action problem stemming from the management of an open-access common pool resource. Learning from recent work on common-property common pool resource management, the adoption of a modified theory of collective action based upon a behavioral theory of the individual allows for a reframing of the climate-change policy challenge. Instead of focusing solely on what policy tools are necessary to impose sustainable use of common pool resources from the exterior, it is more important to develop a context within which collective action becomes possible. Success is no longer tied only to incentives, but equally to the provision of information, learning, and interaction between stakeholders. Further, given the nature of the policy challenge where local actions can have a significant impact on the global outcomes, it appears that actions and multiple scales of government are necessary. The objective of the next section is to explore how the literature treats the interactions and governance processes linking actions that appear necessary to enable collective action and individual behavioral change to reduce greenhouse-gas emissions.

3. LESSONS FROM THE LITERATURE ON INSTITUTIONAL CONTEXT AND GOVERNANCE PROCESSES

Given that the modified theory takes into account transaction costs as well as the provision of information, learning, and interaction among stakeholders, it is important to define 'institutions' and how they shape the context for action. This chapter adopts Ostrom's definition:

> 'Institutions' can be defined as the sets of working rules that are used to determine who is eligible to make decisions in some arena, what actions are allowed or constrained, what aggregation rules will be used, what procedures must be followed, what information must or must not be provided, and what payoffs will be assigned to individuals dependent on their actions (Ostrom 1990:51).

This definition of institutions permits the breaking down of what are often treated as "monolithic" structures into their component parts, allowing for an understanding of how different actors within an institution use information, learn, build trust and act collectively. How institutions are structured influences a number of different elements typically lumped together as 'transaction costs.' Further, as recognized above, it is important to understand that governance processes occur across multiple levels of government and, thus, involve a number of both nested and/or overlapping institutional configurations.

As such, what institutional context can facilitate collective action as defined by the modified theory of collective action described above? While not specifically focusing on climate change, this section reviews first the multi-level governance literature to better understand the relationships and interplay between and within levels of government. The second half of the section will explore how different institutional configurations and decision-making processes that support or undermine the provision of information, learning, and interaction among stakeholders to develop trust and reciprocity, all key to collective action.

3.1. Multi-level and polycentric governance: Conceptualizing relations between institutions

The multi-level governance literature provides a 'flexible' framework to conceptualize the relationship between local authorities, national governments, and the increasing number of non-governmental actors. This framework allows for a better understanding of the contextualization and translation of international and national policies into local-level action (Marks, 1993; Betsill and Bulkeley 2004; Corfee-Morlot, 2009; Corfee-Morlot *et. al.*, 2009; Hooghe and Marks 2003). It can be used to analyze processes operating vertically across multiples scales of government (e.g. local to national) and horizontally across governmental departments as well as non-governmental actors (Bulkeley and Betsill 2005). To take action, local authorities cannot typically operate effectively in isolation from other parts of government. Local governmental authority is often hierarchically "nested" in legal and institutional frameworks at a higher scale (Dietz 2003; Hooghe and Marks 2003; Corfee-Morlot, 2009; Corfee-Morlot *et. al.*, 2009; Corfee-Morlot *et. al.*, 2010; Betsill and Bulkeley 2004). For example, while regional and local policies determine the specific details of land use, human settlement patterns and transportation planning, space for action is usually limited by national development paths, technical standards and funding priorities (Sathaye et al. 2007; Corfee-Morlot, 2009; Corfee-Morlot *et. al.*, 2009; Corfee-Morlot *et. al.*, 2010; Betsill and Bulkeley 2004).

3.1.1. Multi-level governance: Horizontal and Vertical Exchanges

Influence and relationships within the multi-level governance framework function across two principal axes: vertically between levels of authority and horizontally within individual levels. The nesting of local-level action within higher-level institutional and regulatory frameworks is just one example of the inter-linkages that exist between the levels of governance. Actors operating at different levels can be dependent upon one another in at least three ways (Pelling 2006):

- Higher-level organizations shape the operating environment for lower-order actors;
- More-localized institutions can influence (block or support) policy received from higher levels; and
- Action at one level can strengthen or weaken action at other levels – by changing the configuration of hazards, vulnerabilities and institutional capacities.

Equally, in terms of horizontal relationships within levels of authority, the multi-level governance framework treats the subject of "issue-based" governance and the creation of issue-specific administrative and jurisdictional arrangements.

Vertical Relationships

Within the multi-level regulatory environment, a number of top-down and bottom-up processes establish the relationships between the different government levels. In most instances, national governments establish the distribution of competencies across sub-national levels (Betsill and Bulkeley 2004; Hooghe and Marks 2003). In the case of climate change, through the UNFCCC, countries have been active at the international level to establish global greenhouse-gas emission targets through a top-down approach, developing an overarching policy framework for the global challenge. Participating national governments, have, in turn, established domestic ‘Policies and Measures’ (PAMs) targeting, in many cases, the private sector or applicable local-level actors (i.e. the European Union’s Emission Trading System; Sweden’s KLIMP program). This has led to the sub-national contextualization and implementation of international objectives through the development of regulations, such as energy efficiency standards, establishment of R and D programs, etc. (Betsill and Bulkeley 2006; Bulkeley and Moser 2007). Within these policy hierarchies, local governments, in turn, apply and adapt the regulation to their own activities, as well as, when applicable, to households and the private sector. While local policy is inscribed by the distribution of jurisdictional competencies as well as national mandates and regulations, in many instances the individual actions and implementation are adapted to local contexts (Pelling 2006; Urwin and Jordan 2007; Jan Corfee-Morlot et al. 2010).

Additionally, a bottom-up process plays an important role in the governance of climate change. Through a process of experimentation, learning and representation, local-level experiences and interests are able to influence national policies equally, within limits. As particularly seen in the area of adaptation to climate change, local experience has been able to re-frame and retool national, and even international, approaches (Corfee-Morlot et al. 2009; Folke et al. 2005; Moser 2006; Vogel et al. 2007). Local governments are not just policy and regulation makers, but are becoming increasingly active in the development of climate-change actions and approaches (Betsill, 2007).

Horizontal Relationships

Horizontal relationships within the multi-level governance framework include the connections between adjacent local governments, the coordination across function and services within a single government, as well as through formalized networks of authorities. Linkages exist between different local authorities when their jurisdictions overlap or in the governance of a single issue. First, “issue-based” governance, which involves the establishment of task-specific jurisdictions to deal with a single policy area (Hooghe and Marks 2003:10; Foster 1999) demands that appropriate administrative boundaries allow for effective management. These linkages often involve the development of different institutional arrangements, such as separate commissions, boards, metropolitan districts, and informal cooperative mechanisms (OECD, 2010; Walker, 1987; Corfee-Morlot *et al*, 2009) to ensure cooperation between the local authorities on the issue. Second, multi-level governance recognizes that horizontal linkages exist between the different departments and functions within local authorities that must often cooperate to achieve policy objectives. Overcoming the institutional fragmentation where issue-specific services may not communicate or cooperate fully (such as in the context of urban-transport emissions dependent on both transport and urban-planning activities) can characterize the institutional context. Third, learning-information transmission and cooperation also occurs horizontally with linkages increasingly seen between local authorities and regions (Bulkeley and Moser 2007). Taking climate change as an example, horizontal relationships have been created at the local level through the creation of formalized information networks and coalitions (ICLEI, C-40 Cities, etc.) acting both nationally and internationally.

A key part of the horizontal dimension is an open, participatory decision process, a shift from “government” to “governance” as a center for decision making and includes giving greater influence in the policy-dialogue process to business, research and environmental non-governmental organizations (Corfee-Morlot et al 2010; Sathaye et al. 2007:693). This change often facilitates the development of energy and climate policy at any scale as it often requires cooperation across conventional disciplinary and organizational boundaries to bring together sector decision makers, for example in transport, housing or water resources planning, with energy and climate-change experts to consider the implications for sectoral policies and developments. Enabling action at the local level can enhance these participatory processes as decision makers are often in closer contact with local stakeholders and have a better grasp on contextual issues (Corfee-Morlot et al. 2010; Healy 2007; Ostrom 2009). However, in many instances actor preferences may be more homogeneous within a smaller section of the population and, thus, facilitate the development of trust and learning (Ostrom 2009; Corfee-Morlot et al. 2010).

3.1.2. Barriers stemming from a multilevel governance context

Governance of policy issues across multiple levels of government, as well as the encompassing of a broad range of actors, can lead to a number of barriers limiting action. While focusing principally on the vertical relationships between levels of government, recent work by Charbit and Michalun (2009) and Charbit (2011) has identified seven ‘gaps’ or limitations which can result from the macro, multi-level context, including: *Administrative gap* – geographical mismatch between policy issue and administrative boundaries; *Information gap* – asymmetries of information between policy making and/or implementation authorities and between public and non-governmental actors; *Policy gap* – sectoral fragmentation of issue-related tasks across ministries and agencies (also at a local scale between different entities); *Capacity gap* – Insufficient scientific, technical, and implementation capacity on the part of local-issue management actors (size and quality of the infrastructure and resource they must manage); *Funding gap* – Unstable or insufficient revenues undermine effective implementation of issue responsibilities at the sub-national level; *Objective gap* – Different rationalities creating obstacles for adopting convergent targets; and *Accountability gap* – Difficulty to ensure the transparency of practices across the different constituencies. These gaps are useful in establishing the bases for a framework for analysis to assist in the identification of different actions (the modifications of institutional arrangements, the use of different policies such as contractual tools) to reduce difficulties that stem from issues of coordination and capacity challenges (Charbit and Michalun 2009).

Additionally, it is necessary to address the specificities that surround the climate-policy challenge. In the specific case of climate change, the literature confirms that barriers are exacerbated from a system spanning multiple levels as well as integrating a heterogeneous mix of actors and stakeholders. While focusing on the climate-change adaptation challenge, the obstacles to local governance of climate change identified by Corfee-Morlot et al. (2010) equally appear to apply to the greenhouse-gas mitigation challenge. As seen in Table 3, barriers stemming from jurisdictional, political, budgetary and technical issues can limit the capacity of local actors to implement policies. For example, the jurisdictional competencies and boundaries of local actors are traditionally determined by larger national-scale processes. Often, the distribution of competencies and or the alignment of administrative boundaries with that of the policy issues at hand can limit the capacity to act. This can be seen in France, as in many other countries, where the boundaries of urban planning districts may not encompass the entire commuting area.

Table 3: Key obstacles to local greenhouse-gas mitigation action

Jurisdictional and institutional	- lack of mandate to address climate issues - national or regional laws, rules or regulations that lead to increased GHG emissions over time - ill-adapted institutional designs to convene or coordinate across relevant issues (vertically and/or horizontally)
Economic and budgetary	- Distribution of perceived and real costs and benefits - Lack of resources or funding to address the problems identified - Reliance on internal and existing funding mechanisms to augment cost of action
Political	- Local authorities “too close” to different interests - Pressures of short-term electoral cycles on effective risk management and long time lag to reap full adaptation benefits - Lack of willingness to accept costs and behavioral change - Pressure to maintain BAU development pathways
Technical or scientific	- Scientific uncertainty - Inadequate understanding or ignorance of climate-change risks - Lack of technical capacity or access to expertise - Lack of scale-relevant scientific or technical information

Source: After Corfee-Morlot et al. 2010

3.1.3. Towards a Polycentric Governance of Climate Change

Recognizing that the governance of climate change, and more specifically greenhouse-gas mitigation, occurs across multiple levels of governance, administrative jurisdictions and groups of actors prescribing a single institutional configuration is difficult, if not impossible. Nevertheless, decades of research on similar collective-action problems suggest that a “polycentric” order may be of use (Ostrom 2009). Allowing for the linking of diverse systems functioning at both different levels and scales, a polycentric order has been defined as “…*one where many elements are capable of making mutual adjustments for ordering their relationships with one another within a general system of rules where each element acts with independence of other elements”* (V. Ostrom 1999:57). While applied to a larger range of provision of public good (principally education and public safety), the polycentric approach stresses that instead of a single best design, governance should be based on a set of core principles to structure local institutions (Ostrom 2009). This approach is well structured for dealing with climate change in the cases where mitigation action is required across multiple levels and sectors, with regrouping activities functioning at different scales. As Ostrom notes, the polycentric approach “…encourages experimental efforts at multiple levels, as well as the development of methods for assessing the benefits and costs of particular strategies adopted in one type of ecosystem and comparing these with results obtained in other ecosystems” (2009:39).

Box 1 Basic assumptions of polycentric approach

As developed by Ostrom (2009:33-34), a number of principals underlie and structure the polycentric governance approach:
1. Public goods and services differ substantially in regard to their production functions and their scale of effects.
2. Policy preferences tend to be more homogeneous within smaller units than across an entire metropolitan area.
3 Citizens who live in areas served by multiple jurisdictions learn more about the performance of any one jurisdiction by seeing or hearing about how problems are handled in other jurisdictions.
4. The presence of large numbers of potential producers of urban goods and services in a metropolitan area allows elected officials a more effective choice of producers.
5. Multiple jurisdictions with different scopes and scales of organization allow citizens and officials more choice in selecting modes of providing and producing public goods to try to utilize the best available technology, to achieve economies and avoid diseconomies of scale, and improve performance over time.
6. Producers who must compete for contracts are more likely to search for innovative technologies, to encourage effective team production, as well as citizen coproduction, so as to enhance their own performance.

The next section will explore the literature on analyzing institutional structure and identifying the principles from the "environmental governance" of common pool resources potentially applicable to greenhouse-gas mitigation.

3.2. Analyzing Institutional Structure and Principles for Decision Making

While multi-level governance literature elucidates the play between and within different institutional levels, it has not examined how different institutions support or undermine the provision of information, learning, and interaction between stakeholders to develop trust and reciprocity (Ostrom 1998), two key elements to support collective action. As such, it is important to look at the horizontal interaction between 'micro-scale' settings within which cooperation can occur, as well as their vertical relationship with other government levels. Through their work on collective action problems, empirical researchers have begun to identify the characteristics of a setting where collective action is possible:

1. Many of those affected have *agreed on the need for changes* in behavior and see themselves as *jointly sharing responsibility* for future outcomes.
2. The reliability and frequency of *information* about the phenomena of concern are relatively high.
3. Participants know who else has *agreed to change behavior* and that their compliance is being *monitored*
4. *Communication* occurs among at least subsets of participants. (Ostrom 2009:13**)**

In a setting where collective action becomes possible, individual actors must have a common framing of the collective-action problem and, thus, an agreement on how to treat the problem in a shared way. This is facilitated through sufficient information on the issue at hand and the means of monitoring those who have equally agreed to change their behavior. As such, continued communication between the different actors is an essential component of collective action.

3.2.1. Micro-situational variables

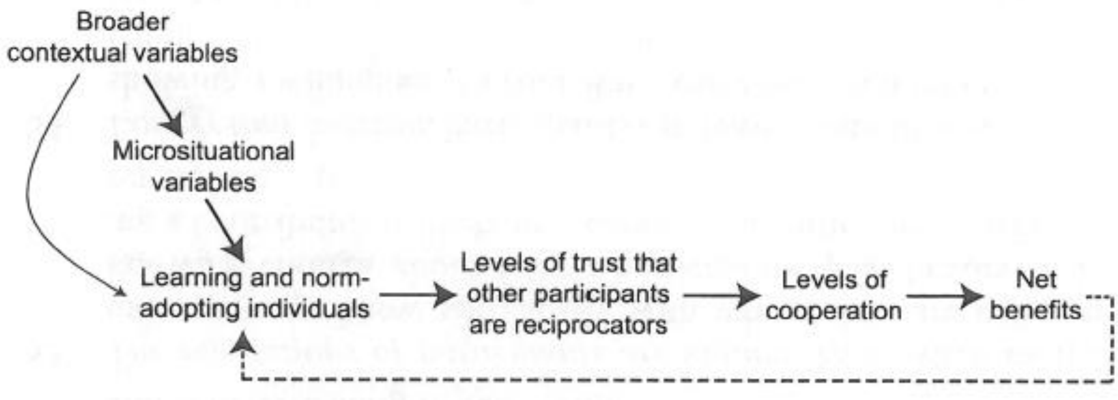
Through their empirical research, Poteete et al. (2010) and Ostrom (2009) have identified what they term as the 'microsituational variables' that influence the context and allow for the type of setting described above to achieve collective action. Among the most important are:

(1) reliable information is available about the immediate and long-term costs and benefits of actions;
(2) the individuals involved see the common resource as important for their own achievements and have a long-term time horizon;
(3) gaining a reputation for being a trustworthy reciprocator is important to those involved;
(4) individuals can communicate with at least some of the others involved;
(5) informal monitoring and sanctioning is feasible and considered appropriate; and
(6) social capital and leadership exist, related to previous successes in solving joint problems.

Further, when individuals and groups face inevitable rules and sanctions imposed by external authorities, these are viewed as legitimate and enforcement is seen as equitable (Ostrom 2009:14). What is striking is that information has a key role not only formulating individual actions, but also in communicating and situating one's actions in relation to other actors. Within this context, the group is able to sanction, both formally and informally, those individuals who have committed to act but are not doing so. As such, active participation within the group takes on a normative quality and influences how individuals are expected to act within the given situation.

As outlined in Figure 4, the broader contextual variables stemming from the position of the different institutions within a larger multi-level governance context combine with the micro-situational context to influence the learning and norm-adoption of individuals. This influences the level of trust of other actors who have engaged within the collective-action problem and, in function of the levels of demonstrated effort and information available, pushes them to reciprocate efforts and cooperation in producing net benefits for the entire group. In turn, this increase in net benefits reinforces the learning and norm-adoption of individuals, thus creating a reinforcing cycle for further collective action (Ostrom 2000; Poteete et al. 2010). As noted by Poteete et al., "the core problem that needs to be solved in order to increase cooperation is creating trust among participants that others are reciprocators, and that cooperating will not make an individual a sucker" (2010:229).

Figure 4: Effects of Broader Contextual Variables and Micro-situational Variables on Collective Action



Source: Poteete et al. 2010

3.2.2. Towards a Governance Framework

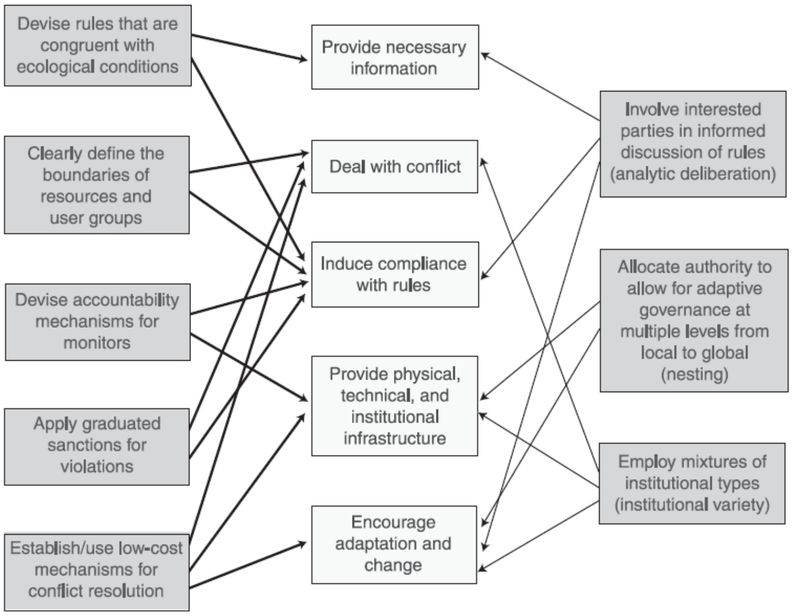
While recognizing the importance of institutional configurations to foster collective action, Dietz et al. have cited increasing pressures of globalization of commerce and production as well as the decreasing levels of face-to-face contact (particularly in large urban areas), "[f]ew settings in the world are characterized by all of these conditions… The challenge is to devise institutional arrangements that help to establish such conditions or… meet the main challenges of governance in the absence of ideal conditions" (Dietz et al. 2008:612). This does not mean, however, that it is not possible to develop governance institutions that treat the important questions of mutual trust, reciprocity and reputation. Instead, they suggest that a number of 'general principles for robust governance of environmental resources' corresponding to a certain number of governance requirements can be identified (as seen in Figure 5).

First, providing information on environmental resources is a key to the governance of the different stocks, flows and processes. It is important to identify the impacts of human actions on the environment as well as link them with different types of policies that can be taken to reduce negative impacts. Dietz et al. stress that "Information also must be congruent with the decision makers' needs in terms of timing, content and form of presentation" (2008:614) as well as meet high scientific standards to ensure credibility. This information can serve as a valuable indicator or signal with which to plan and evaluate action. Second, different mechanisms must be developed to deal with conflict stemming from different perspectives, interests and fundamental disagreements concerning the use of resources (2008:615). Third, conflict-resolution mechanisms should be paired with a means of inducing rule compliance through different forms of graduated sanctions to incentivize both compliance as well as learning (2008:616). Fourth, investments in the necessary 'infrastructure', both in physical (roads, rails, etc.) and institutional terms[16] are important to create the context within which the issue can be managed (and monitored). Finally, Dietz et

[16] Institutional infrastructure in this context refers to research, social capital, and multi-level rules, to coordinate between local and larger levels of governance (Dietz et al. 2008)

al. emphasize the necessity of designing institutions in a manner that allows for change or 'adaptation' to changing states of knowledge, conditions, etc. (2008:616).[17]

Figure 5: General Principles for robust governance (right and left) and governance requirements (center)



Source: Dietz et al. 2008

Drawing on both the multi-level governance literature and the work of Elinor Ostrom and her colleagues, this framework for the governance of environmental resources lays out the general principles to structure the analysis of how local authorities govern greenhouse-gas emissions mitigation. Within the above framework, information plays a key role both to inform and to facilitate communication, as well as to identify and develop the necessary actions and investments and to track changes in conditions. In the case of climate change, greenhouse-gas inventories, marginal abatement-cost curves, emission projections and other informational tools are necessary components to track *a priori* intangible emissions, their sources as well as the performance of mitigation actions. However, a number of issues are raised concerning how information is developed and integrated into the decision-making process by both public and private actors. As such, the following section will explore the literature on the sciences-policy interface and the production of knowledge to inform the decision-making process.

4. INFORMATION AND THE DECISION-MAKING PROCESS

In the above sections, information has been frequently identified as a key element in the management of collective resources. The modified theory of collective action emphasizes the role of information in supporting decision making, learning and building trust. Removing the assumption of perfect information introduces a layer of complexity to reflections on

[17] While Dietz et al. present a model for robust government, it is important to note that the debate, as Foster (1999) remarks, is not as much about the *optimization* of a system towards a given institutional design as finding the necessary institutional arrangements to facilitate the governance of an issue given the local context.

common pool resource problems and collective action. Instead of actors being fully aware of the costs and benefits of their actions, they are rather constrained in terms of how problems and possible solutions are perceived and constructed. Information, whether formalized in the policy processes as an indicator or leveraged through targeted studies, cannot be taken as an a-political technical tool (Dietz et al. 2008; Cash et al. 2003; Cash et al. 2006; Lascoumes et Le Galès 2004; Zittoun 2009). Rather, it is more important to understand what is *not* included than what is contained within a measure. As such, it is key to understand the choices surrounding the development of an information 'instrument' or tool, its functioning as well as how it is used within decision making. As such, a number of questions are raised about the creation and use of information. While policy change can occur for a wide range of reasons, whether based on the interests of politicians and bureaucrats to preserve their position or due to changes in problem definition or the pressures of interest groups (Kingdon 2002), information plays a key role in establishing a common language and framework to discuss a policy issue.

Drawing from the literature on the role of information in governance processes, the following section will focus on how information is produced and used for both public and private actors. The focus is particularly on how information is used in the decision-making process, thus purposefully setting to one side the issues of communication and engagement with the larger public, although this will become an increasingly important issue that merits further attention.

4.1. Information in governance and the decision-making process: informing and guiding debate

In his seminal work decrypting governance processes and how changes in policies occur, Kingdon lays out the key roles of two inter-related processes: problem definition and identification of feasible actions (Kingdon 2002). This interpretation of March and Olsen's 'garbage can model,' considers that policymaking and organizational choice is often used to understand the intersection of actors, a policy problem and different ideas and information at a given moment (March and Olsen 1984). Both Kingdon and Hall identify ideas and information as key means of understanding how issues are framed and how different actions and policies enter into the range of possibilities (Kingdon 2002; Hall 1993). Hall notes that "Policy making in virtually all fields takes place within the context of a particular set of ideas that recognize some social interests as more legitimate than others and privilege some lines of policy over others" (1993:292). As such, it is important to understand how ideas concerning a different policy subject evolve and gain influence. This can often occur through the type(s) of information available used to frame a particular policy problem. Within a *social learning perspective*[18], consistent with the modified theory of collective action laid out above, actors are able to learn from both information and each other, leading to an evolution of the ideas that structure and frame a given issue (Hall 1993:289). As such, it is important to analyze how information enters into decision-making processes, as well influencing both the evolution of larger social norms and influencing policy decisions and outcomes.

[18] Social learning is defined as experience-based learning within a given local context for policy (Hall 1993).

The availability of information is a key factor in how issues are taken up and framed. While simplistic, there is a ring of truth to "what gets measured gets managed."[19] To be taken up, a subject or issue must be given attention and prioritized in comparison to other pressing concerns. While the availability of information on an issue is often not enough to ensure attention (focusing on events such as a crisis and feedback concerning policy failures can have an equally important impact), it can play an important role in getting it on the agenda (Kingdon 2002). For action to occur and an issue to move upwards on the policy agenda, it is important to be perceived as a 'problem' rather than a simple 'condition.' When seen as a problem, the necessity of taking action becomes implicit. This is often linked to how the issue is framed and defined, as well as influencing what data is collected and how it is processed and interpreted. As Kingdon notes: "There are great political stakes in problem definition. Some are helped and others are hurt, depending on how problems get defined" (2002:110). Within this process, values, comparisons to other issues, and existing categories often influence problem definitions (is government intervention necessary, what are others doing about the issue, etc.) How issues are framed will influence who is involved in addressing a problem, what solutions are proposed to solve them, how different actors engage on the issue and what scarce resources are made available (Kingdon 2002). While some values and frames may change, this can be a slow process: Kingdon stresses that "Old categories and old means of classifying subjects into those categories tend to persist" (2002:112). As such, new informational tools or indicators may be key to what and how issues are framed, interpreted and placed on the decision-making agenda.

In terms of greenhouse-gas mitigation, how information is framed can equally influence not only the scope of action and effort, but also the individual solutions deemed acceptable. For example, when GHG mitigation is framed as an energy problem, solutions may focus principally on energy efficiency (technology changes) and fuel switching. However, when framed as an air-pollution problem or part of the larger issue of sustainable development, not only does the scope of solutions (behavioral change, etc.) expand, but also equally a number of individual solutions becomes less acceptable. For example, when the impacts of the fuel-switching focused solutions of diesel vehicles or nuclear-power generation are examined with a larger set of criteria than just GHG emissions, they are rapidly less acceptable to a number of actors. Further, normative ideas concerning how responsibility is attributed, whether it is the consumers or producers of energy, services and products that are responsible for the resulting emissions, can affect how measurements are conducted.

4.2. Information in the Decision-Making Process: Constructed Indicators reflecting preferences, priorities and constraints

One form of information that has been widely treated in the literature is the use of quantified indicators in both public and private decision-making processes. Many authors have noted that indicators are powerful instruments in focusing attention on issues (Kingdon 2002; Zittoun 2009; Lascoumes and Le Galès 2004; Riveline 1991, 2005). An indicator is capable of presenting a complex subject in a 'digestible' form that allows decision makers to

[19] Attributed to Peter Drucker.

grasp a problem better. Each indicator functions in reference to a certain ‘norm’ of what is an acceptable value or level and, thus, allows changes or an existing condition to be compared to a ‘latent’ or business-as-usual state. As Zittoun notes “*Dans certaines situations, l'indicateur non seulement identifie un problème, mais le relie à une cause, à une victime, à un coupable, à un acteur légitime ou encore à un territoire”* (2009:235)[20]. Indicators serve to translate information on a problem into a value or concept not only to indicate that a problem exists, but also to ‘problematize’ it, thus framing it in terms of a set of actors or a set of solutions. As such, the victims of the policy problem can be more clearly identified, as well as the assigning of responsibility for the problem, and often who should bear the costs of action. Often, by anchoring a problem through the identification of both victims and responsible parties, the issue can be pushed upwards on the policy agenda and appropriate courses of action identified (Zittoun 2009:236). Further, and perhaps most importantly, indicators allow for the creation of a common language to discuss what may often be an abstract policy problem and thus “*Il offre une capacité d'abstraction et de circulation qui fait que dans n'importe quelle salle de réunion (donc loin spatialement et temporellement du phénomène lui-même), il est possible de discuter du problème, de son ampleur, de sa nature ou des solutions à apporter*” (Zittoun 2009:240).[21] The creation of a common language, particularly in the context of a complex, transversal policy problem such as climate change, is important to facilitate coordination.

There are, however, a number of limitations placed on indicators, both technical and political in nature. First, Kingdon notes that problems, subjects and aspects that are easily ‘countable’ often receive greater attention than those that are not easily quantified. As such, different indicators - such as ridership in the case of public transport - receive priority while perhaps equally consequential issues, such as quality of service (which is more qualitative and, thus, more difficult to summarize, are not as well incorporated). Thus, the framing and definition of specific issues can be heavily dependent on the quantifiable with the qualitative placed to the side (Kingdon 2002). Second, as for both the private and public sectors, typically only a limited number of indicators are actually used to dissect a problem and influence decision making, with research suggesting no more than three or four (Riveline 1991, 2005). As such, particularly in environmental problems where actions are weighed using environmental, economic and social considerations, there are clear limits to multi-variable analysis and the cognitive capacity of individual actors to use such a wide range of information effectively.

Further, it is important to recognize that an indicator is a process of translating data into a usable fashion, which means that it is not an *apolitical* technical tool. Rather, indicators are based on assumptions that are able to influence the framing and presentation of a policy problem. This is in line with the work of Lascoumes and Le Galès, who have analyzed how different governing instruments, such as indicators, can structure action around a policy problem (2004). When indicators are seen as specifically designed governance instruments, it

[20] “In some situations, the indicator not only identifies a problem, but connects it to a cause, a victim, a responsible party, a legitimate actor or a territory.”

[21]“ It has the capacity of abstraction and circulation of information which means that in any meeting room (distant in both space and time from the phenomenon itself), it is possible to discuss the problem, its extent, nature or identify possible solutions.”

becomes clear that they are much more than only a technical solution. As such, indicators, just as other instruments, can be structured to offset external forces and challenges; produce a particular representation of the relationships between stakeholders; as well as the ability to introduce a hierarchy into the variables surrounding the policy subject and, thus, giving meaning to a particular definition (Lascoumes and Le Galès 2004:31).

This has been further reinforced by the work of Philippe Zittoun (2009). The conclusion of his analysis of a number of case studies looking at the institutional and political context around the elaboration of local-scale indicators in Europe focuses primarily on the fact that "*Les indicateurs forment un instrument particulier qui n'a rien de neutre. Sa fabrique ou sa sélection parmi de nombreux possibles par les acteurs, enferment une série de caractéristiques sociales et politiques…*"[22] (2009:239). As such, their construction can be used to legitimize certain instruments, policies and approaches. Equally, as indicators are often used to trace future scenarios and trends, they offer different actors the possibility to manipulate different parameters, thus creating different visions of the future that can be used to support certain agendas (Zittoun 2009:238). This indicates that indicators can be and are used as a political tool to construct different strategic positions supporting specific actions. This can lead to conflict between different groups of actors, either within or across scales of governance, as different choices in, and in terms of the construction of, indicators can potentially support very different policy options and outcomes (Zittoun 2009; Lascoumes and Le Gales 2004).

Given that indicators are not "…straightforward recognition of the facts…," it is important to understand how decisions are made concerning their construction and the actors there involved (Kingdon 2002:94). The next section will pull from the literature how this process can occur and attempt to identify what institutional configurations can limit their politicization and improve their relevancy.

4.3. Information for 'Learning' and Decision Support: Importance of the Credibility, Legitimacy and Saliency of Information

A body of research attempts to characterize the use of information in the decision-support process, whether discussing the decision making of individuals or those made by elected officials. Complementary to Hall and Kingdon's writing on the importance of information in problem definition and agenda setting (Dietz 2003; Cash et al. 2003; Tribbia and Moser 2008; Corfee-Morlot et al. 2010), a number of authors have focused on the importance of knowledge, information and learning within the decision-making process. These studies treat information and knowledge as a constructed part of the policy process and, thus, attempt to characterize how it is perceived by those involved. Cash et al. (2003; 2006) have attempted to identify the criteria by which information used in the decision-making process will be judged. They posit that the saliency, the credibility and the legitimacy of the information:

[22] "Indicators are instruments that are not neutral. Their creation or selection from among the many possible by the actors embodies a series of social and political characteristics."

> …is likely to be effective in influencing the evolution of social responses to public issues to the extent that the information is perceived by relevant stakeholders to be not only credible, but also salient and legitimate. In the sense used here, ***credibility*** involves the scientific adequacy of the technical evidence and arguments. ***Salience*** deals with the relevance of the assessment to the needs of decision makers. ***Legitimacy*** reflects the perception that the production of information and technology has been respectful of stakeholders' divergent values and beliefs, unbiased in its conduct, and fair in its treatment of opposing views and interests. (2003:8086).

This suggests that the value of the information is not only in its technical exactness, but is equally influenced by how the information is produced as well as how it is integrated into the larger decision-making process. This section looks at the difficulties identified in the production of knowledge and information as well as the role of 'boundary organizations' that are able to negotiate the demands between the scientific and the political in the production of information for decision making.

Often, the idea that with 'more' and 'better' information actors will be able to produce 'better' and more 'informed' decisions dominates debates on the role of information in decision-making processes. However as Tribbia and Moser have identified, more and better information will not necessarily lead to 'better' decisions:

> Many environmental policy initiatives fall short of expectations because experts simply believe that 'better science will lead to better decisions' without fully understanding the decision situation and institutional context within which scientific information could be used… or what a decision-maker could really use (Tribbia and Moser 2008:317).

Further, often the definitions of what 'better' information entails can vary. Experts and scientific researches may associate that 'better' knowledge is about 'getting it right', which can significantly reduce the saliency of information due to time constraints and the need for 'timely' expertise. (NRC 2009; Tribbia and Moser 2008). However, for decision makers, 'better' information may be associated with reducing the margin of uncertainty within the constraints of time and cost. Given that much of the information and expertise used in the decision-making process around environmental subjects tends to include a large margin of uncertainty concerning the scope of impacts, cost, time horizons, etc., conflicts can arise as those providing the information are torn between producing something that is salient, credible and legitimate. This larger "opening-up" (Corfee-Morlot 2009) of the policy process can, however, conflict with an information user's search for a simplified response to a specific, pressing problem.

To overcome these issues, a number of researchers have framed the production of information and expertise as a 'system' rather than a one-way transmission of information from scientists to decision makers who are expected to use it to make better decisions (Cash et al. 2003; Tribbia and Moser 2008; Corfee-Morlot et al. 2011). Within such a system, exchanges between the expert or scientific community and decision makers foster the 'co-production' of knowledge which is viewed as salient, credible and legitimate for all parties involved (Tribbia and Moser 2008). Cash et al. attribute three important tasks critical to the effectiveness of information systems: communication, translation and mediation (2003:8086). First, an information system for decision support must foster active, iterative and inclusive *communication* between the different involved groups. Second, there must be a process of *translating* the scientific information into terms that can be easily accessed and understood by decision makers. Similarly, it is important that the requirements of decision makers be translated into a format that experts can understand in relation to their research. Finally, given the differences in expectations, accountability and priorities among the different actors (experts, decision makers, citizens, etc.) involved in the information development process, *mediation* is important to enhance the legitimacy of the process. This can occur through the "increasing transparency, bringing all perspectives to the table, providing rules of conduct, and establishing criteria for decision making" (Cash et al. 2003 :8086).

4.4. Institutional Context for Information Systems: Boundary Organizations

Finding an institutional form to foster an iterative exchange among scientists, experts and decision makers, however, may not be an easy task. A number of researchers (Cash et al., 2003; Guston, 2001; Gieryn, 1999; Tribbia and Moser 2008; Corfee-Morlot et al. 2011) have suggested that '*boundary organizations'* "…can help improve the end-to-end process of knowledge co-production and application by enabling scientists and decision-makers to increase mutual understanding of capacities and needs while remaining within their respective professional boundaries" (Tribbia and Moser 2008:317). The idea of boundary organizations was first introduced in the 1980s through the work of Gieryn (1983). In the climate-change literature, boundary organizations have principally been applied to the context surrounding the adaptation to a changing climate (Vogel et al. 2007; Tribbia and Moser 2008; Corfee-Morlot et al 2010); however, they equally appear relevant for questions related to greenhouse-gas mitigation. Boundary organizations are agencies or entities that "…have the overall dual purpose of protecting but also transcending the divide between science and practice (e.g., protection from the politicization of science, transcending for improved information flow)" (Tribbia and Moser 2008:317). As such, they are able to treat the concerns raised above related to the politicization of information and indicators, but also the saliency, credibility and legitimacy of the information produced.

Boundary organizations serve two principal purposes in the co-production of information and knowledge. They first facilitate the collaboration between experts and decision makers on different subjects. Second, they are able to produce what has been termed as 'boundary objects' or "…information and things used by both scientists as well as by politicians for different objectives, but without compromising the things themselves" (Guston 2001:401). In the case of climate-change mitigation, greenhouse-gas inventories are clear examples of a co-produced boundary object that is useful to both the scientific community, and decision makers. To achieve these objectives, boundary organizations fulfill a number of functions: *convening, translating, collaboration and mediation* (Tribbia and Moser 2008; Guston 2001; Corfee-Morlot et al. 2011). First, boundary organizations have a *convening function* to bring the different stakeholders together on the issue. Second, as mentioned above, the organization works to *translate* the subject being treated into terms that the different parties are able to understand and then discuss. Third, the boundary organization facilitates an ongoing *collaboration* process, involving frank and transparent exchanges, to co-produce "relevant and scientifically credible, applied knowledge" (Tribbia and Moser 2008:317). Fourth, these organizations play a *mediating* role to ensure the fair representation of the different stakeholder parties involved.

The need for interaction in the production of information and cooperation fits well with the behavioral theory of the individual: individual actors do not have perfect information, but they are able to learn and build trust (Ostrom 2008; Poteete et al. 2010). The above section has laid out how information and knowledge are important in the decision-making process. Information has a key role in what issues make it onto the agenda, their relative priority and how they are framed. This process of framing decisions can have a larger impact on what solutions are identified as feasible and acceptable. Information within decision-making processes often takes the form of a variety of indicators and other informational tools. It is important to recognize their construction, particularly that they are not *apolitical*, but, rather, the product of a certain number of assumptions, interests and decisions concerning what is included and what is excluded. Therefore, it is important to understand how information is produced so that it is perceived not only as credible, but also as salient and legitimate within the decision-making process by involved actors. In many instances, there appears to be a role for boundary organizations, liable to both scientific experts as well as decision makers, in the production of information and knowledge. Through a process of 'analytic deliberation'[23] and the fostering of exchanges between the range of actors involved, they are able to treat the concerns related to the politicization of information and indicators as well as the 'co-production' of salient, credible and legitimate information.

5. CONCLUSIONS

Climate change may very well represent one of the most challenging collective-action problems facing humanity to date. Framing the atmosphere as a sink able to stock only a certain concentration of greenhouse gases before resulting in an increase in the global mean temperature, climate change can be classified an *open-access common pool resource problem*. As such, greenhouse-gas mitigation poses a complex policy challenge spanning multiple levels of government, across traditional sectors and presenting difficult inter- and intra-generational challenges. This chapter has reviewed the current reflections on the *commons* to understand what recent developments in theories of collective action can be used to foster what appears to be the collective action necessary to address such a cross-cutting problem. Drawing from recent work on common-property common pool resource management, this chapter has shown how, in theory, the adoption of a modified theory of collective action based upon a behavioral theory of the individual allows for a reframing of the climate-change policy challenge. Instead of attempting to understand only what policy tool is necessary to impose sustainable use of common pool resources from the exterior, it is equally important to develop a context within which collective action becomes possible. Success is no longer solely tied to

[23] Well-structured dialogue involving scientists, resource users, and interested publics, informed by analysis of key information about environmental and human-environment systems, appears critical. Such analytic deliberation…provides improved information and the trust in it that is essential for information to be used effectively, builds social capital, and can allow for change and deal with inevitable conflicts well enough to produce consensus on governance rules. (Dietz et al. 2008 :616-617)

incentives, but equally to the provision of information, learning, and interaction between stakeholders while simultaneously fostering trust and reciprocity among actors.

Given the nature of the policy challenge where local actions have a significant impact on the global context, it appears that actions' multiple scales of government are necessary (explored further in Chapters 2 and 3). As such, this chapter has analyzed the body of literature on multi-level governance as well as on how different institutions support or undermine the provision of information, learning, and interaction among stakeholders to develop trust and reciprocity, key comments to collective action. To take action, authorities cannot typically operate effectively in isolation from other parts of government. Local governmental authority to act is often hierarchically "nested" in legal and institutional frameworks at a higher scale. Additionally, it is necessary to take into consideration a number of micro-scale characteristics of institutions that serve to foster a context within which collective action can occur. Drawing on work from Dietz et al. (2003), a framework for the governance of environmental resources was identified that lays out the general principles to structure the analysis of how local authorities are structuring the governance of greenhouse-gas emissions.

Within the above framework, information plays a key role to both inform and to facilitate communication, as well as to identify and develop the necessary actions and investments and to track changes in conditions. In the case of climate change, greenhouse-gas inventories and other informational tools are necessary components to track an *a priori* intangible emission. The final section of this chapter analyzed the role of information and knowledge in the decision-making process. Information has a key role in what issues make it onto the agenda, their relative priority and how they are framed. This process of framing decisions can have a larger impact on what solutions are identified as feasible and acceptable. Information within decision-making processes often takes the form of a variety of indicators and other informational tools. As Cash et al. (2003; 2006) suggest, it is key to analyze the legitimacy, credibility and saliency of information and expertise integrated into the decision-making process. As such, it is important to recognize their construction, particularly that they are not *apolitical*, but rather the product of a certain number of assumptions, interests and decisions concerning what is included and what is excluded shaped by the involved actors. Therefore, it is important to understand how information is produced so that it is perceived not only as credible, but also salient and legitimate within the decision-making process by all actors. In many instances, there appears to be a role for "boundary organizations", liable to both scientific experts as well as decision makers, in the production of information and knowledge. Through a process of 'analytic deliberation' and the fostering of exchanges between the range of actors involved, they are able to treat the concerns related to the politicization of information and indicators as well as in the 'co-production' of salience, credibility and legitimacy information.

CHAPTER 2:
BEYOND PRICING CARBON:
INCREASING THE EFFICIENCY OF GREENHOUSE GAS MITIGATION THROUGH LOCAL POLICIES - THE CASE OF URBAN PASSENGER TRANSPORT

1. INTRODUCTION

A principle objective of climate-change policy formulated at the international and national level has focused on internalizing or regulating the negative externalities caused by the use of the atmosphere as a sink for greenhouse gas (GHG) emissions. Much research and policy have therefore focused on the use of what can broadly be grouped as market-based mechanisms that introduce price signals and command-and-control regulations introducing regulatory signals necessary to achieve GHG-mitigation objectives. However, the Stern report (Stern et al. 2006) recognized that while broad new pricing and regulatory frameworks are necessary, they were not sufficient to address the scale of this particular challenge. This is because they only tend to focus on reductions at the margins and thus serve as starting points for more systemic changes. While appropriately pricing carbon and inciting technological innovation and deployment are necessary, attention must be paid to policies designed to reduce systemic and behavioral barriers to greenhouse gas mitigation that go beyond "getting the prices right." To date, a significant portion of both research and policy has focused on determining and "implementing" the appropriate price for greenhouse gas emissions. Less focus has been given to the need for complementary policies that may be necessary to create the context "on-the-ground" to allow for the "efficient" transmission of these signals with the objective of achieving non-marginal and lasting emission reductions.

Conceptualizing climate change as a common-pool resources problem (see Chapter 1), this chapter looks at the relationship between "macro-scale" price and regulatory signals and seemingly necessary "meso-" and "micro-scale" complementary policies. The objective is twofold. First, it is necessary to identify the complementary actions and policies necessary to overcome the various barriers to transmission of price signals. Second, it is equally important to explore the implications of these needed policies on the governance of both transport and urban planning. As such, this chapter takes an interdisciplinary approach to understand the relationships both in terms of economic theory (new institutional economics, principal-agent) and political theory (collective action, behavioral theory of the individual, multi-level governance). Based on these traditions, the chapter looks at the surrounding governance issues, such as the participation of different actor groups, the appropriate level of government for implementation as well as the needs for expertise and information. Throughout this article, the case of emission reductions in the urban transport sector will be used as an example to demonstrate both the need for complementary actions and the distribution of responsibility between national and local-level actors.

This analysis occurs in three parts. First, the analytical framework presented in Chapter 1 will be briefly presented and applied to two examples of the transmission of the price and regulatory signals within the urban passenger-transport sector. Once the barriers to these signals have been identified, Section Two explores what complementary actions appear necessary. Section Three addresses the implications for governance, focusing on actors, levels of government and the information necessary to implement these policies.

2. PRICE AND REGULATORY SIGNALS CONFRONTED WITH MARKET FAILURE, TRANSACTION COSTS AND BOUNDED RATIONALITY

A large portion of research surrounding the identification of the appropriate response to the climate-change policy challenge has applied economic theory, thus treating greenhouse gas emissions as a negative market externality of economic activity. To date, two principal policy signals have been the focus to mitigate this externality: price signals and regulatory approaches. In the first case, negative environmental externalities can be resolved by "getting the prices right" through determining external costs and the application of a tax (Pigouvian approach [Pigou 1920]) or other policy tool. This introduces a "price signal" that, in theory, will lead to an efficient allocation of resources taking account of the externality *within* the market framework. The "price signal" can influence both the quantity of an activity as well as its emission intensity, thus acting on both the supply and the demand. Recognizing greenhouse gases as externalities of economic and social activities, the goal of many of these policy tools is to internalize these costs through placing a price on emissions that reflects the risk or cost to others (Leggett, 2009:24).

Alternately, command-and-control or regulatory approaches have equally been discussed and deployed. These policies, introduced through norms, standards and authorizations, etc., set a maximum level of activity or modify the emission intensity of an activity. In contrast with price signals, such approaches generally attempt to address the sub-optimality of market-based outcomes and address the externality *outside* of the market framework. Because they do not necessarily take account of market-based outcomes, such approaches are often viewed as less efficient in economic terms. However they have been widely adopted in situations where integrating a market externality into market prices is practically difficult to achieve, due to factors such as including informational constraints. Legget (2009) has noted a trend towards regulation in environmental policy in general.

The economic analysis of any policy problem, while both useful and often insightful, typically includes a number of simplifying assumptions concerning the functioning of both market structure and market participants that may not accurately reflect actual conditions. For example, an analysis based on neoclassical economic theory could make a number of assumptions concerning the functioning of the market (rationality of actors, perfect competition, utility maximization) to demonstrate the effectiveness of a price signal to mitigate a given externality. Nevertheless, the results of such an analysis would speak very little of the ability of a price signal to actually be able to influence the emissions of individuals in many real-world situations (Stern et al. 2006). As such, informative, neoclassical approaches have often been critiqued due their reductive assumptions, e.g. concerning natural and free agency, unlimited cognitive capacity, perfect knowledge and pre-existing, stable preferences based on the maximization of utility and use of a benchmark of perfectly competitive general equilibrium (Paavola 2006:3; Klein 1998; Fullerton and Stavins 1998). The following section "rolls back" a number of these simplifying assumptions surrounding the functioning of price and regulatory signals, focusing particularly on assumptions necessary for a perfectly competitive general equilibrium and the rationality of actors.

2.1. Challenging the Assumptions for Perfect Competition and the Rationality of Actors

In neoclassical economic theory, one of the most efficient types of markets is that in which competition is "perfect" between market actors, thus allowing for the rapid achievement of equilibrium and market clearing. This perfection entails that each participant is a price taker and does not influence the price of the product bought and sold. As such, the market price at equilibrium is theoretically equal to the marginal cost of production. Assuming that a market is perfectly competitive and that actors are rational and seek to maximize utility implies a number of simplifying assumptions that, when removed, can greatly influence the efficiency of the price signal or regulatory approach in question.[24] Cases of "imperfect competition" can arise when these conditions are not met and other sources of market failure exist (externalities, public goods, etc.). In these cases, markets for the goods or services in question may not function efficiently or may not be "created" at all.

In line with the theoretical foundations of a modified theory of collective action described in Chapter 1, this chapter uses the idea of perfect competition as a point of departure to peel away the various assumptions in order to understand how price and regulatory signals can be diminished by the context within which they are introduced. To assist in the "rolling back" of the assumption surrounding perfect competition and the functioning of markets, the remainder of this chapter focuses principally on the role of transaction costs, borrowing from the New Institutional Economics theory and introducing the idea of "bounded rationality" of the actors involved.

2.1.1. New Institutional Economics

New Institutional Economics (NIE) adopts a number of the tenants of neoclassical economics; however, there are two significant differences. First, environmental pollution and degradation are seen in terms of *interdependencies* rather than unassigned externalities: the configuration of institutions influences how benefits and costs resulting from environmental degradation are distributed. "The interdependence of agents that have incompatible interests in environmental resources results in environmental conflicts" (Paavola 2006:5). As such, environmental problems are resolved through addressing actor relationships and resolving conflicting interests concerning environmental resources. Within this framework, greenhouse gas emissions can be understood as a common-pool resource where the use of the atmosphere

[24] Such a system is typically defined by the following structural and functional characteristics: infinite buyers/infinite sellers and/or zero entry/exit barriers, perfect factor mobility (free long-term adjustment to market conditions), perfect information, zero transaction costs, profit maximization, homogeneous products, and constant returns to scale (Paavola 2006:3; Klein 1998; Fullerton & Stavins 1998).

as a sink for GHG emissions limits the ability of other actors to do the same (see Chapter 1 for more information).

Second, NIE acknowledges positive transaction costs (Coase 1937, 1960) and how institutional arrangements influence economic outcomes when they are taken into consideration (North 1990). Transaction costs are traditionally defined as the costs of conducting negotiations, seeking information, developing contracts, and monitoring and enforcing compliance (Dhalman, 1979; Barzel, 1985) stemming both from market and non-market transactions. These costs often result from the difficulty of obtaining and processing information and in many instances can be used to explain why institutions exist in the first place. When the transaction costs directly linked to the implementation of GHG reduction measures by individual actors are investigated, it appears that actors attempting to reduce GHG emissions are confronted with a number of transaction costs (search, information, coordination, negotiation) that can decrease the efficiency of the market. For example, the adoption of a new technology by any actor implies a number of costs in addition to the actual purchase and installation charges.

2.1.2. Bounded Rationality of Actors

A second critique of "neoclassical" approaches has focused on assumptions concerning the rationality of actors. While New Institutional Economics has often sided with neoclassical economic theory on this point (utility maximizing), a number of authors question this tenant and have rather advocated the use of a 'bounded rationality' (Williamson 1981; Kahneman and Tversky 1974; Ostrom 1998, 2009). While a full review is beyond the scope of this chapter, it is important to note a number of points. A bounded-rationality approach recognizes that the rationality of individuals tends to be limited by their access to information, their cognitive capacities to accept and process new information and the finite amount of time they have to make decisions. Further, actors tend to have multiple goals that they use to eliminate options from a given set of choices and their ambitions may be modified by the *order* in which they encounter alternatives (Simon 1955; Tversky and Kahneman 1986). As such, actors are known to adopt a number of "heuristics" or mental shortcuts in the processing of new information often linked to their worldview and understanding of complex problems or situations (Kahneman and Tversky 1974). Due to these simplifications, individuals may adopt a risk-adverse behavioral pattern as they continue to profess a given worldview or opinion even in the light of alternative information.

Applying these theoretical concepts described above, the remainder of this section will look at the examples of the transmission of regulatory and price signals in the urban-transport sector to attempt to understand how different barriers stemming from imperfect competition and bounded rationality inhibit their integration into action.

2.2. Price Signals, Regulation and the Urban Transport Sector

Before attempting to trace the pathway of price and regulatory signals in influencing greenhouse gas emissions in the urban passenger-transport sector, it is important to identify a number of general characteristics of the transport sector and the "markets for mobility" that are key in understanding barriers to signal "transmission." This chapter analyses transport in terms of the supply and the demand for "mobility services"; that is, the daily demand based on the need to travel a certain number of passenger-kilometers related to the socio-economic activities that the individual performs each day. This demand is fulfilled through the use of a system of interconnected transport infrastructures, thus indicating the need for a formal transport supply. This supply of transport services can be understood as the supply of passenger-kilometers provided by all of the different modes (personal vehicle, public transport, foot, bicycle, etc.) available to fulfill the corresponding demand.

Worldwide, the transport sector produces 13% of all anthropogenic emissions of GHG gases and 23% of world CO_2 emissions from fossil fuel combustion, rising to 30% in OECD countries (Kamal-Chaoui et al. 2009:84). National trends hold true in urban areas where transport-related emissions typically account for a third of greenhouse gas emissions (Carney et al. 2009). This chapter article focuses principally on urban commuter or "daily" transport demand based around the place of residence - place of employment commute.[25] A relatively simple equation can be used to understand where reductions in greenhouse gas emissions can be found in the transport sector.

$$\mathbf{E_{g,a,t} = A_{a,t} \times F_{g,a}} \qquad (1)$$

where:

E = Emissions of a given gas (g) resulting from a given activity (a) over time period (t)

A = Quantity of a given activity (a) over time period (t)

F =Emission factor (GHG intensity) per unit of activity (a)

In the case of passenger transport, emission reduction can either come through a modification for the demand for mobility **A**, and thus the total number of passenger-kilometers[26] travelled, or through a modification of the emission intensity, **F**, of the transport mode or technology used to fulfill the demand for mobility. Reductions in quantity consumed can be achieved through the reduction of the demand for mobility, and thus transport services, achieved principally by either a reduction of the number of trips or by reducing the distance traveled per trip. Decreasing the emission intensity per kilometer can occur through either an improvement in motor technology, thus improving the GHG efficiency of vehicles, or by a change in modal distribution of trips (private vehicle, public transport, bicycle, walking, etc.).

A range of different policy instruments exists to reduce emissions from the transportation sector (see Table 4). Regulatory tools such as standards for fuel use, emissions and fuel quality can all function to improve the GHG efficiency of both individual private vehicles as well as public transportation. Emission standards for new vehicles, today managed principally at the national level (or that of the European Union in Europe), dictate the quantity of emissions allowed.

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[25] While long-distance, inter-urban transport is of interest, it has less of a structuring effect on intra-urban transportation networks and poses a separate set of policy challenges.

[26] Passenger-kilometers are a measure of the distance traveled by passengers on transit vehicles. It is calculated by multiplying the number of unlinked passenger trips by the average length of their trips.

Price signals can be introduced through traditional means, including taxes, pricing schemes for use of transport infrastructure (highways, railways, airports, etc.). One of the most common means and important revenue sources for many governments are fuel taxes. For example, in France the TIPP (*Taxe intérieure de consommation sur les produits pétroliers*) is an excise tax on petroleum products and is equally an important revenue source[27] for the State. Price signals can also be established through market mechanisms. For example, the proposed US, Australian and New Zealand cap-and-trade systems[28] included mechanisms to cover the GHG content found in liquid fuels. In many cases, this would make fossil-fuel refineries responsible for the GHG content of the fuels they produce and introduce onto the market. Further, while yet to be implemented, experts have proposed different tradable permits systems for the transportation sectors (Raux, 2004; 2008).

Table 4: GHG Mitigation Instruments by Type

Command and Control	**Price Signal**	
Regulatory Policy	*Fiscal Policy*	*Market-Based Mechanisms*
- Norms - Authorizations - Interdictions - Warning Systems - Land Planning	- Emissions Tax - Tax Credits - Subsidies	- Kyoto Flexibility Mechanisms - Cap-and-Trade

Source: After Vallée 2002

It is important to note that in discussing the "price" of mobility services, the cost of transport is typically measured in terms of a *generalized cost function* composed of both a monetary component (cost of use of the mode or infrastructure, etc.) and a temporal component (the value of the amount of time necessary to achieve the amount of passenger kilometers demanded) (Litman 2010). As such, the influence of monetary price signals could be theoretically reduced in the case of transport if counter-balancing changes occur in the temporal component.[29]

The different markets for mobility services are further characterized by a certain number of structural and operational "imperfections" that limit its functioning as a perfect market.

- *Infinite Buyers/Infinite Sellers:* the supply of transport tends to be monopolistic or oligopolistic and in many cases takes on the form of a public good (in the case of road infrastructure, etc.).
- *Zero Entry/Exit Barriers:* instead of zero, substantial entry and exist costs (capital investments, etc.) which place barriers to the entry and exit of both public and private actors;

[27] Around 25 billion Euros a year in the 1990s (Ministère des Finace 2011)
[28] A cap-and-trade system places a cap or a total amount of allowable emissions within an economy, permitting emitters to trade emission allowances within a market to establish a price signal for emission reductions.
[29] For example, the cost of fuel may increase marginally; however, this increase could be rendered less effective if the temporal portion of the generalized cost is reduced through an increase in speed and thus a reduction of travel time.

- *Perfect Factor Mobility* (free long-term adjustment to market conditions): given the high amount of fixed capital invested in the transport infrastructures necessary for the supply, reaction to changes in market conditions are slow;
- *Perfect Information:* information asymmetries exist between transport providers in relation to what services and technologies users are willing to adopt, at what price and at what quantity;
- *Zero Transaction Costs:* there are substantial transaction costs linked to the coordination and deployment of a low-emission, multi-modal offer as well as the provision of information concerning modal efficiency to consumers;
- *Profit Maximization:* profit maximization is bound by the fact that transportation fares are often set following social-distribution policies and users (for both road and public transport infrastructures) rarely pay the full cost;
- *Homogeneous Products*: transportation modes are often not perfect substitutes and suppliers are often involved in the provision of a single mode;
- *Constant Returns to Scale:* transport projects often demonstrate *increasing* returns to scale as the number of users and size of the network increases and learning occurs.

These imperfections are used to understand better how the transmission of the policy signals in the examples below can be inhibited by different barriers.

Further, the markets for transportation and mobility services must equally be understood in relation to a number of associated and "linked" markets. As described further below, it is important to note that the demand for mobility is an induced demand as it is dependent on the spatial relationships between residential, commercial and amenity sites (distance between, clustering of, etc.) (Newman and Kenworthy 1996, 1999; Kenworthy 2003; Bertaud 2004; Bertaud et al. 2009; Kauffman and Sager 2006). As such, the transport services market is innately linked to the real-estate markets, for example, and therefore, the market structure, imperfections and policies found there within (Santos *et al.* 2010). Equally, due to its capital-intensive nature in relative terms for both producers and consumers (limits on perfect factor mobility), transport services markets are equally influenced by rigidities in financial and capital markets.

2.2.1. Example 1: Impact of Price and Regulatory Signals on the Emission Intensity of the Supply

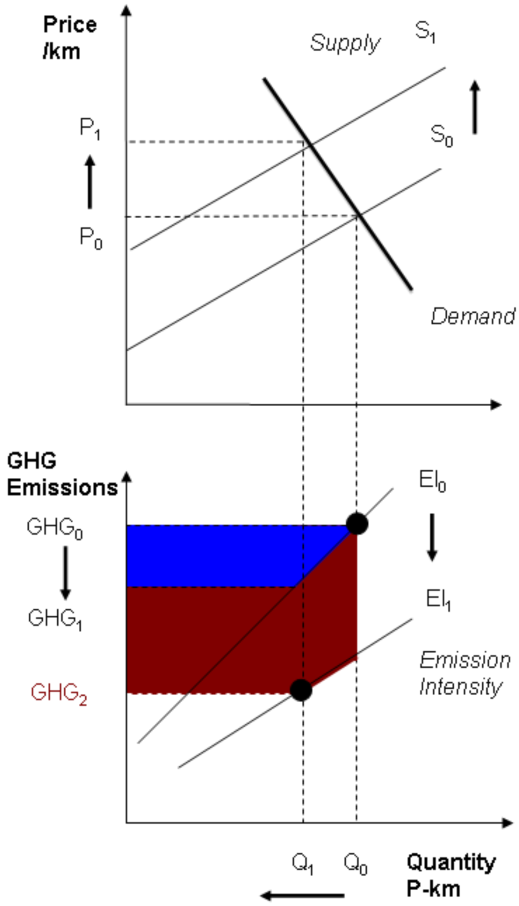
One of the principal objectives of regulatory and price signals is to reduce the GHG-emission intensity per unit of activity (in this case, measured in passenger-kilometers). First, regulatory policy signals can promote a shift to the use of low(er)-emission technologies and processes, thus reducing the overall amount of emissions regardless of share of the different modes of transport. Second, policies can lead to emission reductions without, in theory, influencing the total amount of transport consumed by shifting the distribution between the different modes, thus favoring those which are less intense in GHG emissions and not affected by the price and regulatory signals.

Figure 6 illustrates what would be expected to occur in terms of supply for a quantity of passenger-kilometers given the introduction of both price and regulatory signals and *perfect competition and rational actors*.[30] The first effect occurs in terms of the supply curve

[30] For this example, the simplifying assumption that only a single mode of transport is available is applied.

as the introduced price signal combines with the likely increased cost linked to the transition from business-as-usual (BAU) technologies and practices to best-available (BAT) technologies and practices. As such, an upward shift in the supply curve (SO_0 to SO_1) occurs, leading to a corresponding shift in the level of GHG emissions overall given the change in passenger-kms (GHG_0 to GHG_1). The second effect of the price and regulatory signals acts on the shape and location of the Emissions-Intensity (EI) curve. Regulations constrain users to adopt lower-emission technologies and processes, while, at the same time, the resulting change in emission intensity per mode of transport causes a downwards shift and a change in slope of the EI curve. This results in an even more-significant reduction in GHG emissions (GHG_1 to GHG_2).[31]

Figure 6: ***Transmission of a Regulatory Signal: Elastic Demand***



Source: Author

Barriers to the Provision and Adoption of Low-Emission Technologies and Processes

The ability to shift the emissions intensity of the supply curve downwards requires that lower emission alternatives are first, available, and second, adopted by users. This would, in

[31] While not explored here, it is important to note there is equally the possibility of a rebound effect if the decrease in emissions intensity corresponds to a decrease in operation costs of the vehicle. In the case where the per unit cost of transport decreases, and if the total budget for transport does not decrease accordingly, the quantity of passenger-kilometers consumed may increase. This could potentially lead to a net increase in emissions or significantly reduce potential gains.

theory, require the adoption of BAT technologies in the short-run and the organization and production of a multi-modal passenger-transport supply to better fulfill the demand for a given amount of mobility (passenger-kms) and facilitate modal changes in the long-run.

However, following the theoretical framework outlined above, the provision and adoption of these alternatives can encounter a number of barriers. Rolling back the different assumptions of perfect competition and introducing the idea of bounded rationality calls into question the ability of price and regulatory signals to achieve significant GHG-reduction policies, summarized in Table 5. To achieve these two strategies, a number of actions can be put into place. First, to reduce the emission intensity of each technology, two primary actions appear necessary: in terms of provision, the R&D of technologies and processes and, in terms of commercial availability, their deployment and marketing. Second, in terms of changes in modal distribution, three options are possible: the improved coordination of the existing supply, the development of infrastructure to support low-emission modes (public transit, bike, foot, electric-vehicle charging infrastructure), and the reduction of polluting modes (fossil-fuel-burning private vehicles, etc.).

As seen in Table 5, the specific characteristics of principal and related markets targeted by the different actions necessary to reduce the emission intensity of the transport supply can create a number of barriers to either market creation or market clearing. For example, the adoption of low-emission technologies is intrinsically linked to the low-emission transport technology market (electric, compressed natural gas, hybrid vehicles, etc.) and the deployment of the necessary infrastructure (charging stations, etc.) across the territory. Due to issues of increasing returns to scale, high entry costs linked to network demands and information asymmetries, it is hypothesized that the market tends to function as an oligopoly with a limited number of providers. Equally, there is substantial capital-stock lock-in due to both issues of learning curves for technologies[32] and the medium-term rate of renewal of the rolling stock. A number of externalities of BAU technologies also limits the ability for new low-emission technologies to be competitive in the market, as they are typically not fully integrated and the carbon price signal only effects CO_2e-related externalities.

Additionally, information-, search-, and coordination-transaction costs are present due to the necessity of overcoming existing inertia (processes, technologies). These costs are often related to behavioral barriers present due to how individuals frame the issue, the use of heuristics to order preferences, the inability to recognize substitutes and in many situations the inability to identify the cost-savings and need of switching to low-emission technologies. Finally, the connection with related markets, such as the capital market, limits the ability of both potential providers of the infrastructures to introduce the technologies into the market, and the ability of individual firms and consumers to overcome the potentially significant up-front costs linked to their adoption.

[32] Learning curves for technologies refers to the necessity of reducing the marginal cost of producing each subsequent unit of a new technology at the same level as mature, deployed technologies, with which it competes in the market. Stern (2006) indicates that there is a clear role for public policy to assist with this process.

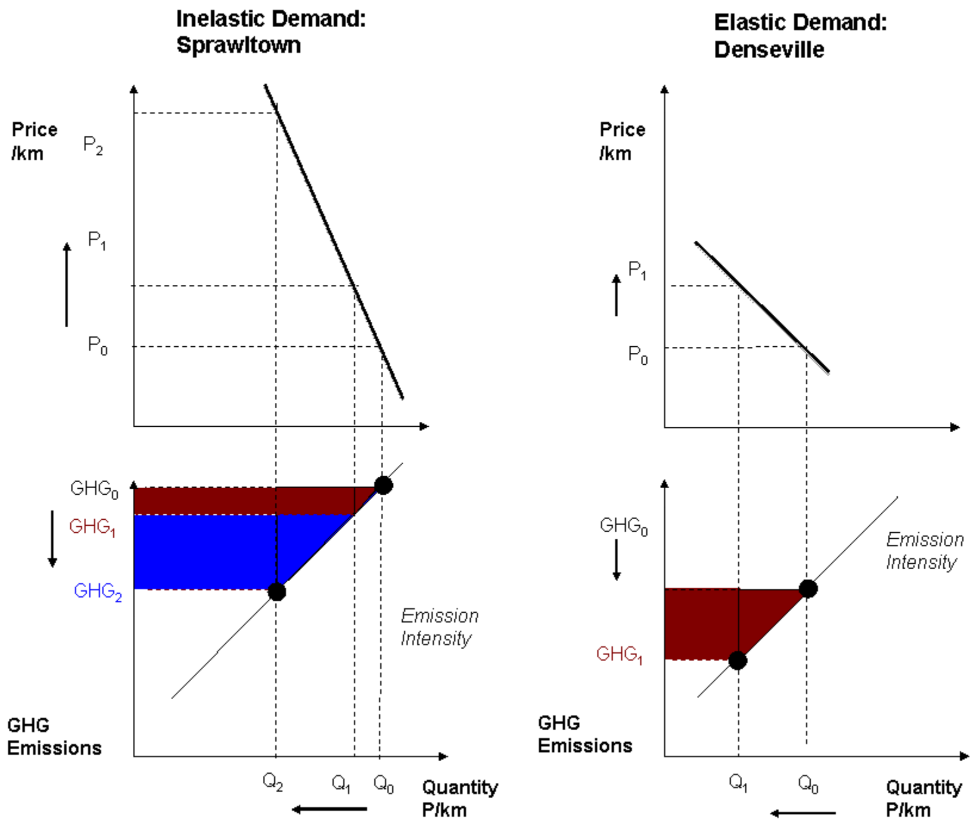
Table 5: Barriers to the Modification of the Emission Intensity of the Transport Supply

			Obstacles to Market Creation / Clearing				
	Actions	**Principal Market Concerned**	**Market Structure**	**Externalities**	**Transaction Costs**	**Behavior (Cognitive)**	**Failures in Related Markets**
Transfer from BAU to BAT technologies	Provision: R & D of technologies	Low-emission technology market	*Oligopoly* - Increasing returns to scale (private-sector provision of technologies must first recoup R&D costs) - High entry costs - Information asymmetries (between suppliers and consumers)		- Information search costs	- Framing of subject (tech change, climate change) - Preferences - Recognition of substitutes - Recognition of need	- Financial market failure (risk capital) - Un-integrated negative externalities in BAU-technology markets
	Adoption of low-emission technologies	Low-emission technology market	*Oligopoly* - Increasing returns to scale - High entry costs (deployment of some technological solutions requires large-scale infrastructure that becomes more viable as the number of users increases -> CNG, non-plug-in electric vehicles, etc.) - Information asymmetries (between suppliers and consumers) *Capital Stock Lock-In* - Learning curve for technologies (Inertia) - Medium-term rate of renewal of rolling stock - Deployment of necessary infrastructure	- Not all externalities of BAU technologies internalized	- Coordination of risk-sharing and performance contracts related to BAT adoption		- Capital-market failures (Access to credit markets to invest in technologies) - Un-integrated negative externalities in BAU-technology markets
Change Modal Distribution							
	Improved coordination (multi-modal) of existing offer	Transport-/Mobility-Services Market	*Monopoly/oligopoly* - Increasing returns to scale - Network effects	- Externalities of modes not integrated - (principally road transport)	- Coordination costs - Contracting costs - Revenue-sharing negotiations	- Framing - Preferences - Recognition of substitutes - Recognition of need	- Un-priced externalities of sprawl in real-estate markets
	Introduction of low-emission infrastructure (public transit, bike, foot)	Transport Infrastructure Market	*Natural monopolies* – (some portions of transport networks are natural monopolies, often resembling public goods in the case of roads, sidewalks, bike infrastructure, etc.) - High entry costs - Learning curve for technologies (Inertia) - Network effects		- Coordination costs (with land-use planning, etc.)		- Rigidities in capital markets (temporal + risk) - Real-Estate Market failure (lack of transport-oriented urbanism)
	Reduce place of private vehicles (road)	Market for private vehicles	*Capital Stock Lock-In* - Inertia	- *Negative Externalities* – (effective pricing of externalities is difficult)	- Coordination	- Framing (perceived loss of welfare) - behavioral inertia	- Quality of offer in public transport and soft-modes

2.2.2. Example 2: Impact of Price and Regulatory Signals on the Demand for Passenger-kms

Price and regulatory signals equally act upon the demand side of the equation presented above in order to reduce the number of passenger-kilometers travelled. This can occur through two combinable approaches: either through reducing the total number of trips or through the reduction of the length of each trip. As illustrated in Figure 7, understanding how the elasticity of demand for the activity is key in determining how a price signal will affect the overall quantity of an activity performed and thus the total GHG emissions produced.

Figure 7 : Impact of Price Signal on GHG Emissions – Inelastic vs. Elastic Demand



Source: Author

Two stylized examples are illustrated in Figure 2: in the case of *Sprawltown* the distance between locations are large and distributed over a wide area with limited mixed use, and *Denseville* on the right, where the urban form is more compact and thus the distances travelled are shorter. On the left, a change in price (P_0 to P_1) given an inelastic demand for mobility will produce a relatively small change in the number of passenger-kms demanded.[33] When the equilibrium is traced onto a given emission-intensity curve EI, in theory a small reduction in GHG emissions occurs. However, in the case of *Denseville* on the right, given a

[33] The demand curve of "Sprawltown" is steep (thus relatively inelastic) and begins further to the right than in the case of "Denseville" as the total distance demanded is higher and the distance between locations is greater.

more elastic demand for mobility as it is possible to complete most activities while travelling shorter distances, a change in price will result in a theoretically larger reduction in the number of passenger-kms demanded. Thus, given the same emission intensity curve with the same slope, this will produce a proportionally larger reduction of emissions. For *Sprawltown* to achieve the same quantity of reduction, the price per passenger-km would have to increase theoretically beyond P_2 to approach the same reduction of GHG emissions (shaded in blue), everything else being equal.

Barriers to the Reduction of the Demand for Passenger Kilometers

In Figure 7, it appears that the shape and initial location of the demand curve (the price elasticity) can greatly influence the ability of a price signal to reduce emissions. As such, the price elasticity of demand for urban passenger transport has an important role to play in the reduction of GHG emissions. In this case, the elasticity is linked to the ability to reduce mobility in general. In economic theory, price elasticity can be modified through the introduction of substitutes. In the case of mobility, two groupings of substitutes appear to exist[34]. On the one hand, the total number of trips can be reduced through actions such as use of teleconferencing or the development of mixed-use areas so a single trip can have multiple purposes. On the other, the distance between locations can be reduced through either moving closer to principal destinations (places of employment, etc.) or, in the long run, a restructuring of the urban environment towards a denser, compact character.

As with the first example, applying the analytical framework reveals a number of barriers stand in the way in the provision and adoption of the substitutes to mobility. Table 6 presents some of these barriers created by the market structure, functioning and links with related markets that inhibit the efficient transmission of price and regulatory signals. Given that the demand for transport is closely linked to the spatial structure, the table principally treats the real-estate market (except in the case of developing the teleconferencing / telescoping market).

Taking the example of reducing the total number of trips by increasing the mixed-use character and thus the productivity of each trip, a number of barriers are related to the real-estate market structure. As seen above, the market is hypothesized to function principally as an oligopoly given the increasing returns to scale-of-development projects and informational asymmetries. This sector has large capital stock lock-in due to the slow rate of renewal of the building stock, limited factor mobility, a number of split incentives for implementing renovation and redevelopment projects and extensive inertia in terms of common development practices. Second, a lack of the internalization of negative externalities induced by urban sprawl, including environmental, social and economic effects, limits needed investment in mixed-use development as "sprawl" development continues to be priced artificially low. As seen above, transaction costs linked to the coordination of mixed use as well as information and search costs are present. Further, issue framing, the recognition of substitutes as well as heuristics equally limit the ability of actors to identify mixed-use

[34] It is important to note that in this example, the substitution between modes of transport is not analyzed, but rather the substitution between "mobility services" or the *need* to travel.

development as a substitute to other types of urban form. Finally, capital-market rigidities (access to up-front financing within long-term payback periods) limit access to financing for both the development of the mixed-use urbanism and its purchase by consumers.

While the above examples present stylized and simplified situations, they suggest that a number of barriers exist to the successful implementation of price and regulatory signals to reduce GHG emissions. The following section presents a typology of the types of actions necessary to overcome these additional barriers.

Table 6 : Barriers to the Modification of the Demand for Mobility

	Actions	Principal Market Concerned	Market Structure	Externalities	Transaction Costs	Behavioral (Cognitive)	Failures in Related Markets
Reduce total number of trips	Telecommuting / Teleshopping	Market for Telecommuting Technologies & Solutions	*Monopoly/Oligopoly* - - Increasing returns to scale *Learning curve* (marginal cost vs. cumulative installation) *Network externalities*		- Search costs - Coordination costs (setting up and coordinating platform)	- Issue framing - Recognition of substitutes	- Technological market failure (R&D and availability of technologies)
	Increased mix-use / local proximity (more services at destination)	Real-Estate Market	*Oligopoly* - Information asymmetries - Increasing returns to scale *Capital stock lock-in* - Slow rate of renewal of building stock - Limited factor mobility (price signal changes demand, but supply requires more time) - Split incentives - Spatial Structure Inertia	- Lack of internalization of negative externalities of sprawl (enviro., social, economic)	- Coordination costs (planning) - Information costs	- Issue framing - Recognition of substitutes	- Capital-market rigidities - Technological-market failure
Reduce distance	Move closer to principal destinations (closer to single location)	Real-Estate Market – dependent on supply of housing near locations	*Oligopoly* - Information asymmetries *Capital stock lock-in* (limited offer) - Slow rate of renewal of building stock - Limited factor mobility (price signal changes demand, but supply requires more time) - Spatial Structure Inertia	- Lack of internalization of negative externalities of sprawl (enviro., social, economic)	- Search costs - Coordination costs - Information costs	- Issue framing - Recognition of substitutes	- Capital-market rigidities
	Increase density of urban area (decrease mean distance from all locations)	Real-Estate Market	*Oligopoly* - Information asymmetries - Increasing returns to scale (greater concentration of services in single area increases overall access for individuals as well as market size for providers) *Capital stock lock-in* - Slow rate of renewal of building stock - Limited factor mobility (price signal changes demand, but supply requires more time) - Split incentives - Inertia	- Lack of internalization of negative externalities of sprawl (enviro., social, economic)	- Coordination costs (planning) - Search costs - Information costs	- Issue framing - Recognition of substitutes	- Capital-market rigidities

2.3. *A Need for Comprehensive Policy Packages for Reducing GHG Emissions in the Urban Passenger Transport*

Given the multiple barriers identified in the two examples above, it is logical to assume that in many cases, markets and private actors alone would be unable to overcome the barriers to efficient greenhouse gas-emissions reductions. This stems from both the necessity to reduce the emission intensity of the supply within the transport sector as well as the organization and restructuring of the urban environment necessary to reduce the demand for mobility. There is little doubt concerning the need for public intervention in the organization of the transport sector, given its frequent categorization as a public service. Public authorities thus have a role to play in assisting private actors to overcome the multiple barriers linked not only to the supply of low-emission transport solutions (technologies, infrastructure, networks) but equally in reducing the overall demand for mobility through increased density and mix-used development.

2.3.1. Policies Addressing Both Transport and Urbanism

A large body of research can be drawn upon to identify the development trends that can lead to a reduction in distance traveled and/or the emission intensity per km. The seminal works of Newman and Kenworthy (1996, 1999) and Kenworthy (2003) clearly link automobile use, urban sprawl, density, energy consumption and GHG emissions, indicating that energy consumption and density in urban areas are negatively correlated. The work of a number of other researchers, notably Bertaud (2004), Bertaud et al. (2009) and Kauffman and Sager (2006), have further nuanced these conclusions, indicating that rather than just focusing on density, it is important to take into consideration the entire urban structure (i.e. the location and distance between housing, services, places of employment, etc.). Combined, this work suggests that the demand for mobility and transport services are an induced demand stemming from the larger urban context. As such, it is important to take into account the interactions between transport and urbanism as reducing both distance and emission intensity. This is linked not only to fostering compact development[35], but also to fostering mixed-use as well and the infrastructure developments necessary to foster shifts between transport modes (pedestrian, bike, personal car, public transport, etc.).

An equally large body of research has devoted its attention to the specific actions and policy options available to achieve reductions in energy use, greenhouse gas emissions and increases in urban density and decreases in urban sprawl. There appears to be a consensus in the literature that addressing emissions from the transport sector requires going beyond technological improvements that, while important, do not treat the continued increase in the number of daily trips and distance traveled (for a recent comprehensive literature review, see Santos et al. 2010a; Santos et al. 2010b; Réseau Action Climat 2007; Verdon et al. 2007; and Lefevre 2010). Research conducted by Lopez-Ruiz and Crozet (2010) for France and

[35] While beyond the scope of this paper, there is an equally larger discussion of the limits of density and the importance of fostering it properly as not to reduce overall quality of life or increase the exposure of populations to negative externalities (i.e. increased local air pollution, noise, etc.).

Hickman et al. (2010) and Hickman and Banister (2007) for the UK have identified a wide range of policies including (presented in Table 11): technical improvements, infrastructure investment, telecommunications technologies, urban planning, pricing and taxation, traffic management information and public-awareness campaigns as well as the use of economic mechanisms (cap-and-trade, etc.). While these policies often function at different levels of government and with different time horizons, they can be used depending on the local context and in a number of different combinations to influence both the distance traveled as well as the emissions per kilometer and thus lead to the reduction of GHG emissions.

Table 7 : Typology of actions to achieve reductions in GHG emissions

GHG-Mitigation Approach	**Urbanism**	**Transport**
Technology Change		- technological improvement in efficiency of vehicles / modes - changes in fuels
Reduce number of trips	- mixed use - increased density - reduce suburban sprawl	
Reduce distance traveled	- increased density - multi-polar urbanism	- reduced speed on roadways - policies to stabilize road congestion[36]
Modal share	- facilitate non-motorized modes - roadway sharing (dedicated bus, tram and high-occupancy lanes)	- public transport infrastructure investment (increased capacity, coverage) - improved operation speed of public transport - reduced / freeze new roadway construction - road/right-of-way sharing - non-motorized transport infrastructures (bike lanes, pedestrian facilities, etc.)
Attractiveness / Quality issues	- landscaping, green spaces - urban furniture, fixtures, infrastructure	- improved public-transport operation - frequency, hours, capacity of service

While a full review of transport and urbanism policies that can contribute to greenhouse gas emission reductions is beyond the scope of this paper, a typology can be used to understand better how to achieve GHG-emissions reductions. As presented in Table 7, the different types of policies can be classified according to their impact on the demand for mobility and emission intensity, whether stemming from transport or urbanism. GHG mitigation can occur either through technology and fuel changes, reductions in the number of trips, reductions in the distance traveled, and change in modal share. A fifth category has been included as while *Attractiveness / Quality issues* do not directly affect GHG emissions, they

[36] The literature suggests that reducing congestion in the short term may be able to decrease greenhouse gas emissions; however, this may, in the long-run, exacerbate urban sprawl as drivers can travel further while "spending" the same amount of time. As such, a number of policies have attempted to reduce road speeds while maintaining the fluidity of traffic to achieve the double dividend of reducing congestion-related externalities while also keep the time-cost stable.

are key in fostering the growth and densification of urban areas as well as public-transportation modes.

A number of actions, focusing either on urbanism or on transport, can play an important role in furthering the different approaches to reduce GHG emissions. The reduction of GHG emissions in the transport sector requires 'packages' of inter-linked and coordinated policies addressing both transport and urbanism. This, in turn, implies that a high level of coordination between those actors responsible for transport and urbanism, whether public or private, local or national, is key to facilitating GHG-emission reductions.

2.3.2. Achieving Reductions: A Clear Need for Cross-Sectoral Cooperation

A large number of studies have begun to identify how these policies can be combined to achieve greenhouse gas-emission mitigation (to name just a few: Banister and Hickman 2005; Hickman et al. 2010; McKinsey and Co. 2009; Greene and Fellow, 2006; Goodwin, 2008; Santos et al. 2010; Michaelis and Davidson 1996; Verdon et al. 2007). Using the theoretical framework presented above, the different policies suggested by these studies can be combined to address the multiple barriers created by market structure, transaction costs, behavior and links to other markets. In many situations, individual policies, such as urban planning, infrastructure development and complementary pricing schemes, can serve to overcome a number of different barriers. Tables 3 and 4 relate a number of complementary policies that can be used to overcome the barriers presented in the examples above.

A few examples can be drawn to clarify the need for policy packages, addressing both the GHG intensity of the supply, and means of better managing the demand, for transport and mobility services. First, in many instances, the investment and financing of public transport requires a level of coordination with land-use, urban development and other policies that render their spontaneous provision by the private sector virtually non-existent. For instance, the deployment of tramways and other forms of lane-segregated mass-transit systems has been identified as a principal means of reducing transport-related GHG emissions (Hickan and Banister, 2007; Kamal-Chaoui and Roberts, 2009). However, the provision and success of these systems requires that they are coordinated with land-use focusing on transit-oriented growth and increased density. A system of incentives or disincentives (subsidies vs. pricing policies) could be used to promote a shift away from road passenger vehicles towards use of the tramway system.

A second set of packages must focus on the provision and adoption of low-emission technologies, modes and urban forms (residential locations, etc.) by individuals. Principally, an individual can choose to adopt a more-efficient personal vehicle or carpool, thus reducing cost as well as emissions, or the option exists to change transport modes, such as walking, bicycling or taking public transportation. However, a number of cognitive barriers and transaction costs are also encountered in the adoption of low-GHG transport-service alternatives. Often, a lack of information needs to be overcome concerning these alternative modes. Individuals can be confronted with search and information processing-related costs that can be overcome by informational campaigns and other means. Even when information is available, barriers related to limits in cognitive capacity and preferences are present, and thus individuals' conceptions of alternatives such as mass transit as viable means of transport in comparison to their cars. Finally, financial tools, such as subsidies ("cash for clunkers") or low-cost financing to aid in the switch between technologies and overcome costs related to high up-front investment in low emission vehicles may also be necessary.

While price and regulatory signals appear to be important incentives in reducing GHG emissions in the urban passenger-transport sector, the above section has demonstrated that complementary policy signals and actions are necessary. What more, these actions must cut across sectors to address issues linked to urban planning and transport as well as access to finance and the necessary capital to achieve the levels of investment necessary in both new technologies as well as low-emission infrastructures. The broad range of actions required raises a number of important questions for the effective governance of such broad-reaching questions. The following section will analyze the implications not only for the involvement of actors, but equally the information and expertise necessary for governance.

Table 8 : Complementary Policies for the Reduction of Emission Intensity of Supply

	Actions	Complementary Policies	
		Provision	**Adoption**
Transfer from BAU to BAT	Provision: R & D of technologies	- Organization of R&D cooperatives between companies - Subsidize R&D research (redundant)	- Flexible patent legislation - Informational campaigns
	Adoption of low emission technologies	- Develop local offer: private-sector training programs; - Contextual regulation: tighter emission standards, vehicle inspections, - Investment and operational subsidies for support networks (CNG, electric)	- Informational measures: labels, campaigns, demonstration - Fiscal incentives: scrapping programs; subsidies, low-interest loans, - Fiscal incentives: road pricing, fuel taxes, etc.
Change Modal Distribution	Improved coordination (multi-modal) of existing offer	- Integrated planning: Development of multi-modal connections (park-n-ride, public-transit hubs, etc.) - Segregated right-of-way for public transit - Organization: route sharing, fare integration, schedule co-ordination	- Fiscal incentives: target pricing of non-GHG road externalities ; subsidies for public-transit use - Informational measures: Real-time travel information for users; personalized service (routes, etc.)
	Introduction of low-emission infrastructure (public transit, bike, foot)	- Investment: public-transport infrastructure - Operational subsidies (due to economies of scale)* - Integrated planning: public-transit-oriented design, density requirements, infill development	- Fiscal incentives: target pricing of non-GHG road externalities ; subsidies for public-transit use - Informational measures: Real-time travel information for users; personalized service (routes, etc.) - Entry restrictions – charging schemes
	Reduce place of private vehicles (road)	- Re-assignment of road space to public transport and soft-modes - Reduced new-road construction - Lower speed limits	- Fiscal incentives: target pricing of non-GHG road externalities ; subsidies for public-transit use - Informational measures: Real-time travel information for users; personalized service (routes, etc.) - Limitations on parking (charges + land-use)

Table 9 : Complementary Policies for the Demand for Transport & Mobility Services

		Complementary Policies	
	Actions	**Provision**	**Adoption**
Reduce total number of trips	Telecommuting / Teleshopping	- Investment: IT infrastructure / platforms	- Information & education campaigns - Voluntary agreements/charters (targets, etc.) - Demonstration projects
	Increased mix-use / local proximity (more services at destination)	- Integrated planning (urbanism, transport, services) - Planning regulations: land-use codes, zoning regulations, - Direct investment in development projects - Financial Incentives: tax reductions, subsidies, - Concentration of public services + facilities	- Information & education campaigns - Demonstration projects (quarters, eco-communities) - Relocation incentives: tax reductions, subsidies
Reduce distance	Move closer to principal destinations (closer to single location)	- Integrated planning (urbanism, transport, services) - Planning regulations: land-use codes, zoning regulations, - Direct investment in development projects - Financial Incentives: tax reductions, subsidies, - Concentration of public services + facilities	- Information & education campaigns - Demonstration projects (quarters, eco-communities) - Relocation incentives: tax reductions, subsidies, access to credit
	Increase density of urban area (decrease mean distance from all locations)	- Integrated planning (urbanism, transport, services) - Planning regulations: land-use codes, zoning regulations, - Direct investment in development projects - Financial Incentives: tax reductions, subsidies, - Concentration of public services + facilities - Local price signals; infrastructure pricing schemes, parking fees	- Information & education campaigns - Demonstration projects (quarters, eco-communities) - Relocation incentives: tax reductions, subsidies, access to credit

3. IMPLICATIONS FOR GOVERNANCE: ROLES FOR ACTORS AND EXPERTISE

The previous section explored the apparent need for complementary packages needed in the transport sector to assist price and regulatory signals to reduce greenhouse gas emissions. This in and of itself is not a necessarily new conclusion, given that a number of authors have also identified this need (Santos 2010 for a review). For example, Stern et al. (2006) particularly calls for public policies to assist in the research and development of new technologies as well as in pushing them along the learning curve and supporting their deployment to create the context within which private-sector action and investment can be leveraged to reduce GHG emissions. However, what has received less attention in the literature are the implications of these needed actions in terms of the governance of greenhouse gas mitigation. Specifically, it is important given what appears to be a need for a "polycentric" governance involving actors spanning multiple levels of government (see Chapter 1). As such, it is important to explore how these different policy responsibilities and actions should be distributed vertically and horizontally among the different levels of authorities. Further, both the actions needed and the participation of a wide range of different actor groups have implications for the expertise and information for governance.

3.1. Actor Groups Spanning Public and Private Sectors as well as Multiple Sectors

Organization, design, implementation and evaluation of the different complementary policies to reduce GHG emissions in the urban-transport sector identified above require the involvement of a large range of actor groups. These different groups involve both the public and private sectors as well as the input and participation of both experts and the larger general public. Different expectations concerning their roles, given both their jurisdictional capacities as well as their interests and logics, can be attributed to the different groups. As such, it is expected that public actors provide the legal institutional framework within which actions occur; the private sector (with or without public assistance) is often looked to in the development and deployment of technologies, contracted service provision. Experts are expected to provide best-practice information and the necessary technical input to identify the optimal policy solutions; the general public is expected not only to modify their behavior, but also provide needed information on the political acceptability of measures identified through different consultation processes (Verdon et al 2007).

When focusing on a single sector, such as urban passenger transport, actors equally span across multiple sectors. As seen in Table 10, while reductive and non-exhaustive, different actor groups are often positioned at different levels of government. Coordinating and achieving collective action in terms of urban mobility can be challenging as the number and type of actors involved in the transport sector is highly diverse. As noted by Jouve in his 2002 study of the *Plan de déplacement urbains* of Grand Lyon, over 14 different professions and types of actors can be involved in the development of plans and projects. Within the transport sector, the actions identified above require actions not only from those involved in the planning, financing, constructing and operation of transport infrastructure and services, but equally involves those involved in research and development and other forms of transport-related research. The engagement and participation of actors across sectors is equally necessary: planners, developers, investors and the entire academic and professional community surrounding urban development are needed.

Table 10 : Actors involved between and across levels of governance

	Public	Private Enterprise	Experts	General Public
International	- International structures (i.e. UNFCCC)	- Multinational companies	- Technical bodies - Researcher - Consultants - Agencies - Local NGOs - Local experts	- Multiple levels of elective circumscriptions - Media, associations in spreading and inciting debate
National	- National governments - Ministries	- National companies / subsidiaries		
Regional	- Sub-national authorities (regional, urban, rural) - Planning agencies and authorities	- Small and medium enterprises - Local operators		

This constellation of actors scattered across different levels has implications for the distribution of competencies, roles, resources as well as the need for coordination, given what appears to be a clear need for coherent policy packages to reduce greenhouse gas emissions. Explored further in later chapters, this complex constellation spanning sectors, types (public, private, etc.), and levels influences the governance of the subject as coordinated action requires finding the common denominator for a wide range of priorities, definitions and measures of success as well as basic approaches in framing issues (explored further in Chapters 1, 3, 4, 5).

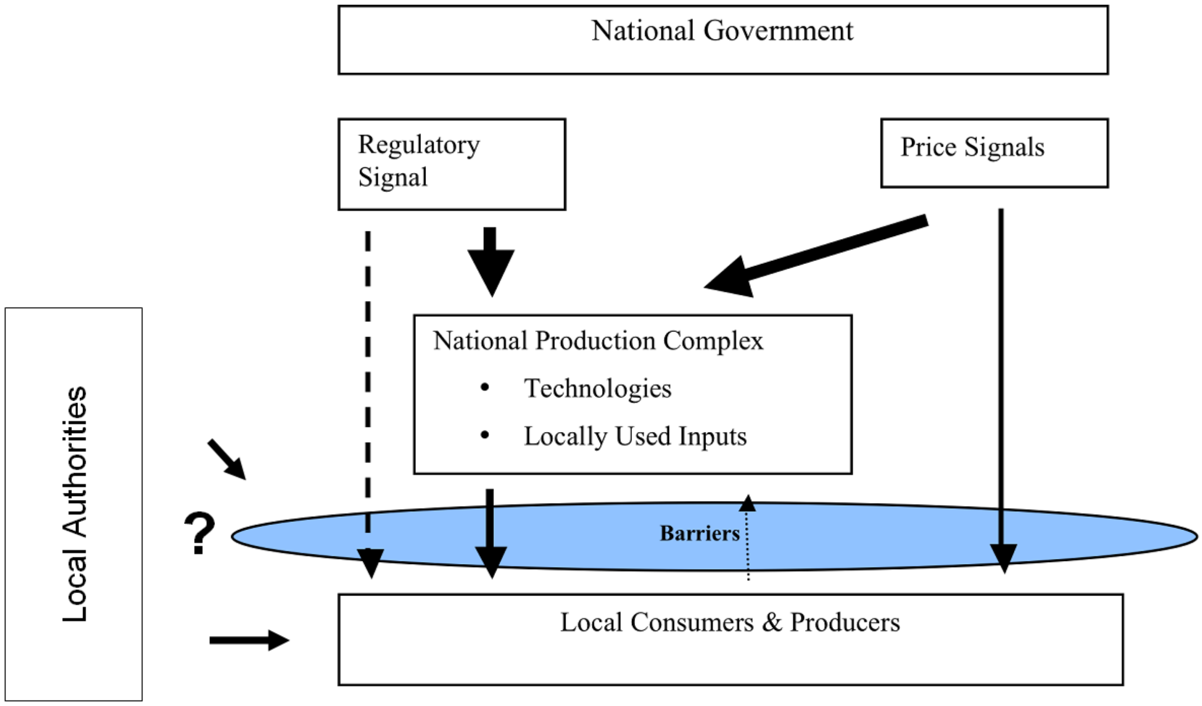
3.2. Distribution of Policy Competencies across Levels

As seen in Figure 8, this chapter conceptualizes climate policy as a closed system where a national government puts into place price and regulatory systems with the objective of influencing the behavior of individual local consumers and producers (the site of demand for and conducing of GHG emissions). These policy signals are translated by a theoretical "national-production complex" made up of a range of both public and private actors responsible for producing the technologies and inputs used at the local level.

As widely accepted, regulatory and price signals are a necessary component of climate-change policy. To avoid leakage and ensure competitiveness between local areas, as well as given their influence over the "national-production complex", national governments are in the best position to implement over-arching price signals and regulation (although in some instance local authorities might be able to tailor them depending on the context). Thus, national authorities should most likely implement price and regulatory policies affecting the entire national economy and setting a base standard for action. However, when the question of the appropriate level for complementary actions is addressed, the answer appears less clear-cut.

A number of different schools of thought can be tapped to attempt to characterize and understand how the distribution of policy tools and responsibilities should occur across the levels of government. On the one hand, welfare economic theory indicates that the proper level is that where all externalities are/can be internalized or that where the largest economies of scales can occur (Jordan 2000). In terms of climate policy, this would indicate that the global level is the most appropriate for internalizing the global externalities of GHG emissions. On the other hand, the political theory of subsidarity,[37] extensively applied in various forms worldwide, indicates, rather, that action should be coordinated at the lowest relevant level of governance (Collier 1997; Jordan 2000).

Figure 8 : Transmission of Macro Policy Signals



Further, a number of different literatures have attempted to identify the costs and benefits of acting at different levels of government, including *Transaction Cost Politics* (Williamson 2005; Dixit 1997; Brousseau and Raynaud 2006; North 1990) and *Fiscal Federalism* (cf. for a recent survey Oates 1999). Both attempt to identify the optimal levels of governance taking into consideration a range of transaction costs on the one hand (information costs, contracting and enforcement costs, opportunism, etc.) as well as informational asymmetries and the scope of goods in question. This type of analysis is useful to determine theoretically the appropriate level. Brousseau and Raynaud conclude that there are a number of benefits to the centralization of action, including scale and scope effects (positive-network effects by using common standards for interactions…), learning and specialization benefits, reduction of collective welfare losses (greater consistency of local

[37] Subsidiarity promotes the management of a policy subject by the smallest unit of government competent to do so.

rules, internalization of externalities, etc.). However, they equally identify a number of costs, such as static maladaptation of policies (due to heterogeneity of preferences and contexts), dynamic maladaptation (reduced re-negotiability and, thus, inability to adapt over time), cumulative information asymmetries, increased enforcement requirements (thus increasing incentives to free ride) as well as the increased possibility of well-organized private capture (given the greater incentives to distort collective governance at the national level) (Brousseau and Raynaud, 2006).

As seen in the Chapter I, an additional layer of theory building on a number of the above points adds to the identification of appropriate levels of deployment. The Behavioral Theory of the Individual (Ostrom 2009; Poteete, Janssen and Ostrom 2010) expands on the bounded rationality of actors within the context of achieving collective action. Within this theory, it is assumed that individuals do not possess perfect information, but are capable of learning from more-accurate information through interaction in a given setting. Further, while individuals do seek self-benefit, their preferences regarding others and their norms concerning appropriate actions in a given setting can vary. Given this bounded rationality, Poteete, Janssen and Ostrom have identified a number of contextual variables that appear to influence the likelihood of collective action including reliable information, reputation development, communication among actors as well as the importance of common resources for the different actors (2010). Given this importance of the development of trust among actors, clear information on the local impacts of the policy problem and the policies themselves and the ability for informal monitoring and sanctioning, the relevancy of the local level for action is reinforced, particularly in terms of removing a number of the barriers to behavioral change.

3.3. Towards Polycentricism: Reinforcing the Necessity of Multi-Level Governance

Intuitively, following the logic presented above, local authorities rather than national governments appear ‘better’ positioned to overcome a large number of the barriers cited previously. Applying the qualitative “costs and benefits” of centralized action, Table 11 presents an analysis of transport-urbanism policies and actions with the ability to influence the demand for mobility and/or improve the emission intensity of supply available at the local level. This is paired with the need for the development of trust and coordination for the collective action indicated above. While qualitative, the analysis indicates that in a number of different situations the costs of centralized action in terms of ‘maladaptations’ of policy and informational asymmetries, when combined with the requirements for enforcement and the building of trust, appear to outweigh the benefits of centralizing the policy at the national level of government.

While difficult to analyze when abstracted from a particular institutional context, a number of larger lessons can be drawn. In terms of transaction costs and informational asymmetries linked to the level of detail needed for urban planning, the development of transport infrastructures and the organization of multi-modal offers, it appears that local governments, closer to the “ground,” are in a position to do so. The same stands to reason in terms of coordination of the large number of actors that are involved in the organization and implementation of these policies. Often, local authorities are also in a privileged position vis-à-vis the general population to build a sense of confidence and trust around a project or policy that, as described in the behavioral theory of the individual, is crucial to the success of collective actions. This reasoning is reinforced by the fact that the majority of the complementary policies fall into the domains already assigned to local authorities, including land-use, transportation, planning and many forms of direct public-service provision. Further, in many cases cities and other local governments hold the unique potential to work closely with local constituencies to develop visions of the future that match the needs of these constituents (Brunner 1996; Moser and Dilling 2006). Policy experimentation at the local level can lead to the diffusion of approaches both between cities and regions, as well as inform national and international approaches as both hard- and soft-policy measures are adjusted to better foster promising solutions (Corfee-Morlot et al. 2009).

While it cannot respond to what level is best for the implementation of policies, the theories of multi-level and polycentric governance create a framework to understand the relationships between international-, national- and local-level action (Hooghe and Marks 2003; Betsill and Bulkeley 2004; Bulkeley and Schoeder 2008; Corfee-Morlot 2009; Corfee-Morlot et. al. 2009; Ostrom 2009). Within the multi-level regulatory environment, a number of top-down and bottom-up processes establish vertical relationships between the different levels of government involved. In a top-down fashion, regulation and overarching policy frameworks established between national governments create supra-national bodies that transmit binding and non-binding policies and objectives to national governments. This creates a system within which local-level action is nested hierarchically within large-scale institutional and regulatory frameworks. Allowing for the linking of diverse systems functioning at both different levels and scales, a polycentric order has been defined as "…*one where many elements are capable of making mutual adjustments for ordering their relationships with one another within a general system of rules where each element acts with independence of other elements"* (V. Ostrom 1999:57). As Ostrom notes, the polycentric approach "…encourages experimental efforts at multiple levels, as well as the development of methods for assessing the benefits and costs of particular strategies adopted in one type of ecosystem and comparing these with results obtained in other ecosystems" (2009:39).

Table 11 : Organizational Costs and Benefits of the Centralization of Policy

Measure	**Benefits of Central Action**				**Costs of Central Action**					***Appropriate Level***
	Broader scale and scope of action	Learning & specialization benefits	Reduction of collective-welfare losses	Financing (access to capital)	Information Asymmetries	Enforcement requirements	Trust & Coordination Requirements	Maladaptation (heterogeneity of contexts)	Maladaptation (flexibility over time)	
Technical Improvements										
Standards for emissions, noise and safety	x		x			x				***National***
Fuel-quality standards and alternative fuels	x		x			x				***National***
Infrastructure Investment										
Improvement of public transport - bus, guided bus and LRT (define), ultra-light rail, palletisation		x		x	x		x	x	x	***Local***
Public transport subsidy (investment)				x	x		x			***National***
Inter-modality		x		x	x		x	x	x	***Local***
Traveler information		x			x		x	x	x	***Local***
Park and ride					x		x	x	x	***Local***
Walking and cycle facilities					x		x	x	x	***Local***
Telecommunications and Technology Development										
Telecommuting/teleconferencing	x	x	x					x		***National***
Teleshopping/telebanking/	x	x	x					x		***National***
Urban Planning										
Integrated planning		x			x	x	x	x	x	***Local***
Mixed use		x			x	x	x	x	x	***Local***
Zoning regulations		x			x	x	x	x	x	***Local***
Public-Transport-Orientated Development (PTOD)		x			x	x	x	x	x	***Local***
Clustered land use/location-efficient development		x		x	x	x	x	x	x	***Local***
Fiscal incentives for relocation in designated areas		x		x	x	x	x	x	x	***Local***
Regeneration of decaying areas (city centre, inner city, waterfront, suburban)		x		x	x	x	x	x	x	***Local***

Measure	Benefits of Central Action				Costs of Central Action					*Appropriate Level*
	Scale and scope	Learning & specialization benefits	Reduction of collective-welfare losses	Financing (access to capital)	Information Asymmetries	Enforcement requirements	Trust & Coordination Requirements	Maladaptation (heterogeneity of contexts)	Maladaptation (flexibility over time)	*Appropriate Level*
Pricing and taxation										
Road pricing – congestion or environmental basis					x	x	x			*Local*
Fuel tax	x	x	x							*National*
Vehicle-purchase tax	x	x	x							*National*
Parking tariffs/pricing		x			x	x	x	x	x	*Local*
Parking restrictions/controls					x	x	x	x	x	*Local*
Traffic management										
Access restrictions		x			x	x	x	x	x	*Local*
Road-space reallocation		x			x	x	x	x	x	*Local*
Priorities lanes for high-occupancy vehicles (HOV)		x			x	x	x	x	x	*Local*
Lower speed limits and enforcement		x			x	x	x	x	x	*Local*
Information and public awareness, incentives for change										
Campaigns to promote environmentally friendly modes		x			x		x			*Local*
Increased awareness of public-transport services		x			x		x	x	x	*Local*
Travel information		x			x		x	x	x	*Local*
Personalized travel planning, travel blending		x			x		x	x	x	*Local*
Commute trip-reduction programs		x			x		x	x	x	*Local*
Demonstration Projects		x			x		x	x	x	*Local*
Economic/Wider Policies										
Tradable mobility credits	x	x	x							*National*
Carbon rations/Domestic Tradable Quotas (DTQs)	x	x	x							*National*
Carbon tax	x	x	x							*National*
Taxes and fees based on fuel consumption and weight	x	x	x	x						*National*
Vehicle scrappage bonuses and tax increases	x	x	x							*National*

Source: Author after Brousseau and Raynaud 2006; Bartlett School 2006

Looking at the results of the analysis presented above in Table 11 through the filter of a poly- or multi-level governance approach may allow for a better understanding of how local action can facilitate nationally-established price and regulatory signals in influencing behavioral change and achieving GHG reductions. The local level may be the appropriate level to develop and implement a wide range of transport and land-use policies. However, what perhaps is less evident is the need for continuity across levels of government. For example, the national level has an important role in setting wider economic policy. Larger economic and regulatory frameworks affecting the entire national economy should be homogenized across the territory. Further, centrally coordinated policy has the possibility of producing learning and specialization benefits. While it seems clear that local authorities are the appropriate actors to develop and implement integrated planning, zoning regulations and multi-modal facilities, the national government can again play a role in assisting different local authorities to learn from each other's experience, making available the needed expertise to develop these plans and establishing the base criteria and indicators through which they should be elaborated and evaluated.

Consistent with multi-level governance, however, local authorities should have the ability to use these larger price signals and regulations as a base to build upon. Placing a number of pricing and standard-setting capacities at their disposition allows for the targeting of price signals (through road pricing, congestion charging, parking fees, etc.) within a specific context. Further, local authorities may be able to place more strict regulations (minimum density thresholds, emission standards, etc.) than those present at the national level to aid in achieving specific reduction objectives.

However, what the above analysis does not treat is the horizontal relationships that exist within different levels of governance. The local level may be the best level at which to develop and implement a number of complementary policies; however, it is equally important to break open the "black-box" to understand how the interactions between different services, governance bodies and administrative jurisdictions are equally important. While a full analysis of this is beyond the scope of this paper, a brief example from the French case can illustrate the need for further exploration of this subject.

3.3.1. Example of Multi-Modal Transport Provision in France: Coordination of Actors

In France, the creation of a multi-modal transport supply is dependent on the actions of multiple governing bodies at different levels. The central government sets a number of policies concerning fuel prices, norms and regulations, as well being active in funding the development of the necessary infrastructures to reduce the modal share of personal vehicles and increase the use of public transport and soft modes. Local authorities are responsible for the development of a number of planning documents concerning transport and urbanism. However, the local level is not composed of a single authority. In France, four different types of local authorities with different, but overlapping, jurisdictions and competencies co-exist without a set hierarchy between them. As such, the Région, the largest administrative unit, is responsible for the deployment and operation of heavy-rail services. The Départements are responsible of the non-local bus services connecting urban areas. Where they exist, inter-communal structures (EPCI) are responsible for urban public transportation. Finally, the Communes are typically solely responsible for land-use planning, the granting of building permits and the development of local roads.

While a wide range of planning tools, processes and documents have been developed to aid in the coordination of these different entities, a number of horizontal barriers to the integration of climate change into the planning process still exist. The coordination of action between levels is necessary in the production of complementary policies to create the context for GHG-emission reductions. It seems critical to identify what indicators and tools may be available to assist both national and local governments to reduce the potential costs of coordination between levels of government as well as capitalize on the potential co-benefits. One with a seemingly strong potential is that of using compatible greenhouse gas inventories as an indicator not only to understand the impact of individual actions better, but also to create a shared language concerning climate change between national and local authorities as well as local consumers and producers

3.4. General Implications for Expertise for Decision-Making

As discussed in Chapter 1, both theory and empirical research indicates that information is frequently identified as a key element in the management of collective resources. Expertise and information have key roles in supporting decision-making, learning and building trust. Both Kingdon (2002) and Hall (1993) identify ideas and information as key means of understanding how issues are framed and how different actions and policies enter into the range of possibilities. In addition, one form of information that has been widely treated in the literature is the use of quantified indicators in both public and private decision-making processes. Many authors have noted that indicators are powerful instruments in focusing attention on issues (Kingdon 2002; Zittoun 2009; Lascoumes and Le Galès 2004; Riveline 1991, 2005). Complementary to Hall and Kingdon's writing on the importance of information in problem definition and agenda setting, a number of authors have focused on the importance of knowledge, information and learning within the decision-making process (Dietz 2003; Cash et al. 2003; Tribbia and Moser 2008; Corfee-Morlot et al. 2011). These studies treat information and knowledge as a constructed part of the policy process and thus attempt to characterize how it is perceived by those involved.

Information tools have multiple roles to play, particularly in the case of governing GHG emissions. Different studies, indicators, inventories and other "tools" aid in a number of decisions-making processes including:

- *Diagnostic and Baseline* – profile of GHG-emission sources within the area of study to identify principal sources and understand evolution over time without intervention
- *Analysis of Actions* – analysis of the direct and indirect impacts of emission-reduction policies, often linked to analyzing their cost-efficiency in terms of cost per ton CO_2e reduced
- *Scenario Analysis* – analysis and comparison of the mitigation (both direct and indirect) of potential policy "packages"
- *Tracking Progress* – deployment of periodic or punctual indicators to track progress towards emission reduction goals

- *Ex-post Evaluation* – analysis of actions taken and identification of their effectiveness

In many instances these different tools have not only different data requirements (level of detail, time horizons), but equally deploy different methodologies in calculating the impacts of both single as well as groups of actions on GHG emissions. The methods deployed can range from cursory estimates of GHG emissions from individual sources to complex socio-economic analysis based on highly quantified cost-benefit-analysis principals. As such, expertise on GHG emissions is often linked to other subjects, whether it be economic (cost of ton CO2e reduced, GDP, etc.), social (accessibility to transport services, quality of housing, etc.) or environmental (local air pollution, energy use, etc.). This linking is often key in understanding how GHG mitigation is framed in relation to other, often more-pressing, priorities of the different actor groups.

The transversal nature of the actions necessary to reduce greenhouse gas emission in the urban passenger-transport sector suggests that linkages will need to be established between the expertise and information that drive often sectorally divided processes. Drawing on the case from Grenoble Alpes Métropole and Nantes Métropole, the following section will illustrate general lessons on the impacts.

3.4.1. The Technical Challenge of Linking Transport and Urbanism Analysis

First, in terms of technical analytical limits for evaluating sectoral issues, the development of the expertise and information for planning documents and what appears to be needed multi-criteria project evaluation requires a wide range of social, economic and environmental data that often is not fully available. As such, local authorities are not in a position to produce or analyze the necessary information to understand the long-term transport and land-use trends as well as the appropriate interventions to achieve objectives. This is further exacerbated by the evaluation of the interactions between transport and urbanism in general. This limit may stem from the inability to collect and treat the necessary data, as well as difficulty in evaluating impacts from a single transport or urban intervention upon the entire networks and system. Often this requires the development and use of extensive and complex modeling tools that are intensive in data needs. For example, Grenoble Alpes Métropole has calibrated the Visem/Davisum model to simulate transportation flows. This model, however, is highly dependent on the results of the household mobility survey (*l'Enquête Ménages-Déplacements*) which is conducted at a relatively large cost (more than two million Euros) approximately every 10 years. Further, this model is not able to simulate the dynamic relationships between transport and urbanism, which is particularly needed in developing a multi-criteria analysis based on both transport and urbanism objectives for decision making (Gusmeroli 11.10.21).

Further, it is not necessarily possible to measure "linearly" the impacts of actions and "packages" of policies. As Verdon et al. (2008) note, within a single sector it is rare that the sum of the impacts of individual projects is equal to the total impact. Policy overlaps, indirect impacts, such as induced traffic, may not appropriately capture the results of a set of policies. This is further complicated when considering the impacts of both transport and urbanism projects, often functioning through different incentives, different time horizons as well as responding to separate logics concerning desired outcomes.

3.4.2. Limits of Tailoring Information for Multiple Actor Groups

Given the broad number of actors that must be brought together to coordinate urbanism and transport policy, there is little surprise that different perspectives and decision-making rationalities can create obstacles to adopting convergent targets and needs for expertise. Attempts to coordinate actors with divergent framings of the subject as well as goals can inhibit the development of an ‘integrated approach’ through which the synergies between transport and urbanism can be fully exploited. These differences in objectives can stem from differences in priorities of actor groups, but also from the larger systemic differences in how professional cultures frame issues and policy solutions. For example, France is typically marked by a segmentation of the engineering culture by subject areas, which can influence how different professions frame and view subjects (Poimboeuf 2010; Pezet-Kuhn 2010). Thus, wide differences can occur in terms of the policy problem to be solved and the appropriate solutions to apply.

Transport and urbanism can be framed in very different ways, and thus similar issues can have different objectives depending on what approach is being used. While a simplified characterization, it can be said that those approaching the subject with an urban-planning perspective take a more holistic, systemic approach, where as transport engineers often take a more “project-based” approach. For example, in the Grenoble Alpes Métropole area, the process of increasing density within the urban area is seen as a means of achieving different objectives and thus framed differently depending on professional cultures. Urban planners see increasing density and mixed-use as a means of reducing urban sprawl, reducing transport demand across the entire urban area as well as producing a better balance between the localization of employment, services and housing. However, for urban planners, this must be done in a way that continues to make the agglomeration livable and attractive, including limiting the exposure of the population to pollutants. While transport engineers also emphasize the need to increase density, this stems from density as a means for rendering different technical solutions feasible. As such, densification is concentrated along existing or projected transportation axes in order to increase demand for mobility services within that area. While this is not antithetical to the objectives of urban planners, there is less of a holistic approach in terms of other objectives, such as reducing exposure of the population to pollutants, as these tend to increase along transport corridors, etc. As such, in both Nantes and Grenoble, both highs and lows have been noted in the relationships between those services dominated by an urban planning perspective and those services dominated by transport engineers, often due to differences in framing objectives and solutions.

These differences in framing objectives and solutions can be linked to the priorities and preferences of the different actors involved, much of which is dependent on how success is measured and to whom actors are accountable. This has an impact in terms of how expertise and information are structured for decision-making. Transport engineers tend to conceptualize transport-related objectives in terms of passenger-kilometers, number trips, length of trips, number of available seats and total network capacity, etc. These indicators focus principally on the transport network and individual technologies and projects, rather than the impacts on the larger urban environment. Urban planners tend to use more ‘macro’ measures of overall density, production of housing, global transport demand and impacts on the real estate markets. As such, the levels at which the two professions focus may lead to difficulties in establishing common objectives as one tends to focus on individual technical solutions while the other attempts to address the larger system. For example in Grenoble, when addressing climate change, transport engineers typically focus technical solutions to reduce emissions rather than directly addressing the larger problems of continued increases in energy demand, no matter its method of generation (Uhry 2010).

The above section has explored how the complementary packages needed in the transport sector to assist price and regulatory signals to reduce greenhouse gas emissions impact not only governance of climate change, but also equally the transport and urbanism sectors themselves. The needed actions require a large constellation of actors spanning not only traditional policy sectors (transport and urbanism) but also across all actor groups (public, private, expert, etc.). Further, it is important to understand how these actions are spread across different levels of government and governance with certain types of actions concentrated in the hands of national, regional or local decision-makers and actors. Finally, the section has explored the impacts of both the necessary actions and actors on the expertise and information needed at all stages of the policy-making and implementation process. Differences in information used by different actor groups, as well as how progress and success are measured, can influence both cooperation as well as the structure of the information necessary for the incorporation or mainstreaming of greenhouse gas mitigation into sectoral decision-making processes. This has implications for both the technical and actor-based aspects of how information is structured, the methodologies used and how they are linked to other policy priorities for the actors groups involved.

4. CONCLUSIONS: TOWARDS A COORDINATION OF CROSS-LEVEL POLICY ACTION

While price and regulatory signals appear to be a pillar upon which greenhouse gas mitigation policy should be and is being built, it should not be forgotten that more than this might be necessary. This chapter has presented a framework to understand the role of complementary policies in assisting national emissions pricing and regulation in achieving real GHG emissions reductions better. Using the case of urban transport, the barriers posed to the effective transmission of price and regulatory signals from the global/national to the local level have been identified. These barriers stem not only from characteristics of the market itself (oligopoly, increasing returns to scale, capital stock lock-in), transaction costs, externalities, but are also tied to barriers to achieving behavioral change and linkages with other markets (capital, real-estate, etc.). Overcoming these barriers requires a range of complementary actions and policies from both the transport- and urban-planning sectors. These actions potentially serve to enhance the influence of price and regulatory signals and create a context for non-marginal and successful GHG mitigation.

The second half of the chapter has looked at the implications of these complementary policies in terms of the governance of greenhouse gas mitigation. First, in terms of the involvement of different actors groups, instead of price and regulatory policies held principally at the national level, a larger range of actors must take action across multiple levels. The needed actions require a large constellation of actors spanning not only traditional policy sectors (transport and urbanism) but also across all actor groups (public, private, expert, etc.). Applying a qualitative analysis of looking at the potential transaction costs, informational asymmetries as well as the necessity of building trust and coordinating actors to achieve collective action, it appears participation is needed at multiple levels of government and governance to achieve objectives. Explored further in later chapters, this complex constellation spanning sectors, types (public, private, etc.), and levels influencing the governance of the subject as coordinated action requires finding the common denominator for a wide range of priorities, definition and measures of success as well as basic approaches in framing issues. This results in a number of recommendations concerning the necessary strategic orientations and policy strategies to be adopted (presented in Table 12). These recommendations are linked not only to larger strategic orientations to ensure coherent approaches in the urban passenger transport sector, but equally policy strategies for achieving objectives.

Finally, the range of actions required as well as the needed participation and coordination of a wide range of actor groups have a number of potential impacts on the expertise and information for decision-making and implementation. First, a number of technical difficulties exist in attempting to understand fully both individual and packages of policies in terms of GHG emissions within a single sector. This is further complicated when the combined impacts of both transport- and urbanism-policy programs are evaluated. These limitations stem not only from data constraints and differences in methodologies, but equally from the difficulties in evaluating systemic impacts in general. Second, differences in terms of how policy issues are perceived by differing professional cultures, different framings of issues (and their solutions) and how success is measured introduces a number of requirements on expertise expected to play a transversal role in injecting or mainstreaming greenhouse gas mitigation across sectors. This suggests that a polycentric-governance approach is the most appropriate where action is distributed vertically and horizontally across multiple levels of governance.

This chapter has explored the barriers, identified the actions necessary as well as the need for actor groups to function within a polycentric-governance framework. Nevertheless, a number of questions still remain to be answered that could potentially reduce the contribution in terms of the efficiency of local-level action. Above all, it raises the important question of how coordination across sectors, levels of government and actor groups can occur within a given institutional context. Further, the creation of a common language and indicator set, potentially through the use of greenhouse gas inventories, may prove an import component not only in coordinating action, but also in putting into place the complementary policies necessary to improve the efficiency of greenhouse gas-emission reductions through price and regulatory signals.

Table 12 : Recommended Strategic Orientations and Policy Strategies for GHG Mitigation in the Urban Passenger Transport Sector

	Strategic Orientations	General Policy Strategies
French Central State	Foster: - Nation-wide greenhouse gas mitigation mandates and signals - Synergies between national and sub-national policies - Linkages between transport and urban planning - Local-level action on transport and urbanism issues - Low-emission-technology research and development Avoid: - "Siloed" policy making in transport and urbanism	Strategies: - Implement national "price on carbon" and other greenhouse gas emissions - Establish regulatory framework to reduce GHG emissions through norms, standards and other nationally-established regulations - Decentralize competencies for local-level actions on transport (congestion changing, access issues, decision-making) and urbanism (land-use planning, zoning) with appropriate oversight to assure respect of national objectives and orientations - Linking of transport and urban planning decision-making processes at all levels of government - Establish a frame for stable local funding for transport and urbanism projects - Provide technical assistance to local authorities on transport, urbanism and greenhouse gas mitigation
Intercommunal Structure	Foster: - Address transport and urban planning holistically through integrated "packages" of policies - Emphasize the quality of the urban environment and transport system produced Avoid: - "Siloed" and fragmented policy implementation	Strategies: - Reduce distance traveled and number of trips - Promote low-emission technological adoption - Redistribution of modal share (reduce role of personal vehicles) - Promote dense, mixed-use development of quality Methods: - Regulatory tools - Financial incentives - Education campaigns - Infrastructure and public-transport provision - Rehabilitation and large-level development of urban areas - Restriction of diffuse development in peripheral areas - Operational improvements

SECTION TWO
LOCAL ACTION AND INSTITUTIONAL CONTEXT IN THE POLYCENTRIC GOVERNANCE OF CLIMATE CHANGE IN FRANCE

CHAPTER 3:
ACTION CONSTRAINED BY CONTEXT:
INSTITUTIONAL ARRANGEMENTS AND GHG MITIGATION IN THE URBAN-PASSENGER-TRANSPORT SECTOR

1. INTRODUCTION

A number of different actions and policies have been identified as potentially significant means of reducing greenhouse gas emission in the urban passenger transport sector. While the creation of a carbon price and the direct regulation of activities remain important, as seen in Chapter 2, actions taken across multiple levels of government can serve as necessary complements to overcome barriers to GHG mitigation. Technological improvements as well as specific policy tools, such as congestion charging or the development of public transportation, are positioned as the keys to achieving the reduction of greenhouse gas emissions. While these individual policies have often received significant attention, the organizational and institutional configurations that can facilitate GHG reductions have received less attention. Given that climate change is a transversal subject, cutting across not only different sectors but also levels of government as well as between public and private actors, the organization of the constellation of actors involved can impact the capacity to achieve the collective action and behavioral change necessary to reduce emissions.

The objective of this chapter is to explore how the arrangement of actors and institutions influences their capacity to reduce GHG emissions in the urban passenger transport sector in France. To do so, the multi-level governance arrangements of transport and urbanism are analyzed to identify the barriers to reducing local transport-related GHG emissions in France. First, the multi-level structure of the separate, but often overlapping, transport and urban policies is charted. Second, combining an analysis of the institutional arrangements with the policy strategies that have been widely identified in the literature as a means of reducing GHG emissions allows for the identification of potential barriers. It is hypothesized that the ability of local authorities to foster the collective action necessary to reduce GHG emissions from the urban passenger transport sector is limited by both fragmentation as well as limitations in terms of expertise and information.

Section 2 reviews the context and trends concerning transport, urbanism and greenhouse gas emissions in France. Section 3 briefly presents the institutional arrangements for the governance of transport and urbanism in France. In Section 4, this information on the larger institutional context will be combined with empirical findings from two case studies, which have been conducted in Nantes Métropole and Grenoble Alpes Métropole to identify the fragmentation and limitations in terms of resources imposed by the current institutional arrangements. Finally, Section 5 will briefly explore the actions to resolve the barriers that have already been implemented or are in development as well as the necessary steps needed to enable local actors to reduce emissions in the transport sector.

2. TRANSPORT, URBANISM AND GHG-EMISSION TRENDS IN FRANCE

In 2007, transport was the principal emitting sector in France: it was responsible for 25% of energy consumption and, due to the high dependence on fossil fuels, close to 34% of national CO_2 emissions (CITEPA 2009).[38] For France to respect its *Facterr 4* (see Chapter 4) commitment or the reduction of GHG emissions by 75% by 2050 (2005 levels), substantial reductions must be expected from the transport sector: typically representing a halving of base-year emission levels within the sector. However, not surprisingly, transport emissions are highly linked to evolutions in both economic development as well as models of development. Without changes in current demand for mobility and technology trends, energy use and emissions in this sector are expected to increase given that mobility and transport demands are likely to increase within the continued economic growth. This appears particularly correlated with transport speeds, which steadily increased over the last decades where a 1% increase in GPD has consistently lead to a 2.7% increase in speed, thus representing an ever-increasing distance travelled, given that the amount of time consecrated to transport activities has remained constant in France (approximately one hour/day) (Lopez-Ruiz and Crozet, 2010).[39] As such, the three principal means of reducing GHG emissions in the transport sector are technological changes, modal shifts (away from personal vehicles) and reductions in the distance travelled.

2.1. Actions for Reducing GHG Emissions in the Urban-Passenger Transport Sector: the Necessity of Transport and Urban Planning

A large body of research identifies the development trends that can lead to a reduction in distance traveled and/or the emission intensity per km. The seminal works of Newman and Kenworthy (1996, 1999) and Kenworthy (2003) clearly link automobile use, urban sprawl, density, energy consumption and GHG emissions, indicating that energy consumption and density in urban areas are negatively correlated. The work of a number of other researchers, notably Bertaud (2004), Bertaud et al. (2009) and Kauffman and Sager (2006), have further nuanced these conclusions, indicating that rather than just focusing on density, it is important to take into consideration the entire urban structure (i.e. the location and distance between housing, services, places of employment, etc.). Combined, this work suggests that the demand for mobility and transport services are an induced demand stemming from the larger urban context. As such, it is important to take into account the interactions between transport and urbanism as reducing both distance and emission intensity, which is linked not only to fostering compact development,[40] but also to fostering mixed-use as well as the infrastructure necessary to foster shifts between transport modes (pedestrian, bike, personal car, public transport, etc.).

[38] This places transport well in front of Industry, representing 25% of CO_2 emissions and residential/tertiary (22%) and the power sector (17%) (CITEPA 2009).
[39] Research has demonstrated that, to date, the demand for transport and mobility services is directly correlated with economic growth.
[40] While beyond the scope of this paper, there is equally a larger discussion of the limits of density and the importance of fostering it properly as not to reduce overall quality of life or increase the exposure of populations to negative externalities (i.e. increased local air pollution, noise, etc.).

A large number of actions, focusing on either transport or urban planning can play an important role in furthering the different approaches to reduce GHG emission. These policies are classified in Table 13. The reduction of GHG emissions in the transport sector requires 'packages' of inter-linked and coordinated policies addressing both transport and urbanism. This, in turn, implies that a high level of coordination between those actors responsible for transport and urbanism, whether public or private, local or national, is key to facilitating GHG-emission reductions.

Table 13 : Typology of actions to achieve reductions in GHG emissions

GHG-Mitigation Approach	Urbanism	Transport
Technology Change		- technological improvement of vehicle efficiency / modes - changes in fuels
Reduce number of trips & distance traveled	- mixed use - increased density - multi-polar urbanism - reduce suburban sprawl	- reduced speed on roadways (increased time costs) - policies to stabilize road congestion[41]
Modal share	- facilitate non-motorized modes - roadway sharing (dedicated bus, tram and high-occupancy lanes)	- public-transport infrastructure investment (increased capacity, coverage) - improved operation speed of public transport - reduce / freeze new roadway construction - road/right-of-way sharing - non-motorized transport infrastructures (bike lanes, pedestrian facilities, etc.)
Attractiveness / Quality issues*	- landscaping, green spaces - urban furniture, fixtures, infrastructure	- improved public-transport operation - frequency, hours, capacity of service
* *Attractiveness / Quality issues* do not directly affect GHG emissions; hey are key in fostering the growth and densification of urban areas as well as public-transportation modes.		

2.2. French Urban-Passenger Transport and Urbanism Trends: Suburban Development Leading to Increased Transport Demand

The last few decades in France have been marked by a continued increase in development in suburban (peri-urban) areas, typically within the greater metropolitan areas, but beyond the direct administrative control of the *communautés urbaines* (C.U.) and the *communautés d'agglomeration* (C.A.). For example, in the surrounding Grenoble Alpes Métropole (*La Métro*) area, 89% of recent demographic growth has occurred outside of the C.A., with only 11% within. Conversely, the majority of job creation and employment continues to occur within the C.A. with 77% of job creation occurring within the agglomeration and only 23% outside (EPSCOT 2010). While a decrease in the number of

[41] The literature suggests that reducing congestion in the short term may be able to decrease greenhouse gas emissions; however, this may, in the long-run, exacerbate urban sprawl as drivers can travel further while "spending" the same amount of time. As such, a number of policies have attempted to reduce road speeds while maintaining the fluidity of traffic to achieve the double dividend of reducing congestion-related externalities while also keeping the time-cost stable.

trips within the agglomeration has been noted, the imbalance of work and residence location has exacerbated the noted increase in the number of trips between the agglomeration and the suburbs as well as an increase in the number of trips around the periphery of *La Métro*.

Table 14: Evolution of Modal Share in the Grenoble Urban Area 2002-2010

		Car	**Public Transport**	**Bikes**	**Walking**	**Other**
Greater urban area (2002 boundary)	2002	62%	10%	2%	24%	2%
	2010	59%	12%	3%	25%	1%
La Métro (2002 boundary) 23 communes	2002	52%	14%	3%	31%	1%
	2010	46%	17%	4%	32%	1%
Pays du Grésivaudan	2002	75%	6%	1%	18.5%	2%
	2010	69.5%	9%	1%	18%	2%
Pays Voironnais	2002	74%	5%	1%	18%	2%
	2010	71%	6%	1%	20%	2%

Source: SMTC 2010

Nevertheless, the aggressive development of the public transport over the last few decades in the Grenoble area has begun to bear fruit. At 3.6[42] (SMTC 2010) the average number of trips per person per day is slightly above the national average as compared to 3.2 trips per person per day.[43] Nevertheless, for the first time in 40 years, the total number of car trips within the *communauté d'agglomération* has decreased. The 2009-2010 household mobility survey (*l'Enquête Ménages-Déplacements*) in the larger Grenoble urban area indicates that public transport modes have made modest gains across the region (see Table 9). Within the perimeter of *La Métro*, between 2002 and 2010, an 18% decrease in car trips was noted with a 13% and 44% increase in bus and tramway as well as bicycle modes, respectively (SMTC 2010).

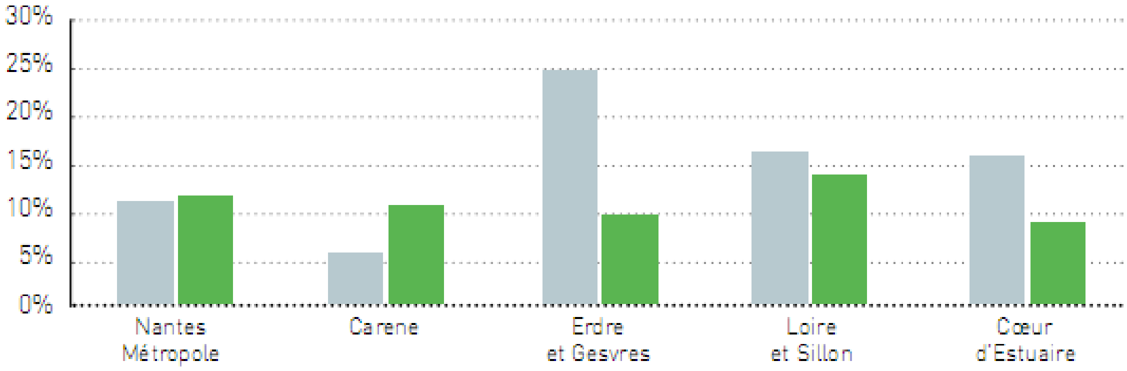
However, as also seen in see Table 9, the percentage of public transport and non-motorized modes has equally increased outside of *La Métro's* perimeter. Given the difficulty of providing public-transport services in areas below a certain level of density, it is not surprising that the automobile remains the dominant mode, representing up to 75% of all trips in some suburban areas.

As seen in Figure 9, similar trends have led to an increasing imbalance of residence and employment in the Greater Nantes Métropole urban area. Between 2002 and 2008, the daily number of trips increased less than 1%, with an average 3.5 trips per resident per day, remaining again above the national average of 3.2 (AURAN and Nantes Métropole 2010). An aggressive public-transport policy has led to a reduction of the number of personal vehicles entering the perimeter of Nantes Métropole by 12%, with an accompanying increase by 26% in the use of public transport. However, as seen in Table 15, personal vehicles account for 57% of trips within Nantes Métropole, increasing to over 70% outside of the perimeter of the *communauté urbaine*. Further, with only limited access to public transports due to the under-development of commuter rail services in the greater metropolitan area, public transports are

[42] This nevertheless represents a decrease of 1% from 2002, the date of the last mobility survey.
[43] Based on 14 large agglomerations

available principally only in the urban centers (Scot. Métropole 2004), thus explaining the dominance of car-use in suburban areas.

Figure 9: Imbalance of Residence-Employment in the Greater Nantes Métropole Area



Change 1990-1999 in the labor force in number of jobs

Source: After Scot. Métropole 2004

Table 15 : Modal Distribution of Trips by Residential Location in the Nantes Urban Area (2008)

	Nantes Métropole 2008	**Inhabitants within the ring road 2008**	**Inhabitants outside the ring road 2008**	**2010 PDU Objective**
Car	57%	46%	71%	50%
Public Transport	15%	17%	11%	18%
Other	28%	34%	18%	32%

Source: AURAN and Nantes Métropole 2010

The mitigation of greenhouse gas emissions in the transport sector requires that a holistic approach is taken, addressing both the supply- and demand-side of mobility. While sectoral policies can improve the efficiency of the transport supply through technological changes, etc., it is important to address equally demand-side issues stemming from the larger questions of urban development. As seen in the cases of Grenoble Alpes Métropole and Nantes Métropole, the increase in growth of residential activities in suburban, peripheral areas with a continued concentration of economic activity in the central areas continues to lead to increases in demand for mobility. In Grenoble, even with aggressive action, GHG emissions from the transport sector have continued to increase overall, even if total emissions from the agglomeration have decreased by 5.4% between 2005 to 2008 (La Métro 2009). In both Nantes and Grenoble Alpès Métropoles, transport emissions represent approximately 30% of GHG emissions. Often, given the relatively low-levels of density and the long distances in suburban development, the private vehicle is the only viable option in many cases. As such, it appears, beyond a doubt, that the long-term mitigation of greenhouse gas emissions in the transport sector requires the coordination of transport and land-use.

3. INSTITUTIONAL ARRANGEMENTS IN FRANCE

As described in Chapter 1, multi-level governance provides a flexible framework within which to conceptualize the relationship between local authorities, cities, national governments, and the increasing number of non-governmental actors. This framework allows for an understanding of the contextualization and translation of international and national policies into local-level action (Hooghe & Marks 2003; Betsill and Bulkeley 2004; Bulkeley et al. 2009; Corfee-Morlot 2009; Corfee-Morlot et. al. 2009). It is used to analyze processes operating vertically across multiples scales of government (e.g. local to national) and horizontally across governmental departments as well as non-governmental actors (Bulkeley and Betsill 2005; UNFCCC, 2006). To take action, local authorities cannot typically operate effectively in isolation from other parts of government. Local governmental authority to act is often hierarchically "nested" in legal and institutional frameworks at a higher scale (Dietz 2003; Dietz et al. 2008; Hooghe and Marks 2003). Further, influence and relationships within the multi-level governance-framework function across two principal axes: vertically between scales of authority and horizontally across scales. The nesting of local-level action within higher-level institutional and regulatory frameworks is just one example of the inter-linkages that exist between the scales of governance.

This section explores the existing institutional framework governance in urban transport and urban-planning decision-making and implementation in France. While the decentralization of authority from a historically State-centered model to the appropriate sub-national institutional actors should be seen as progress towards more contextualized governance; the resulting large number of local-scale actors has created a fragmented governance context.

3.1. A Fragmented Decentralization of Competencies

The French institutional context for governance has traditionally be highly centralized and dominated by the central State. Since the 1980s, the process of decentralization of competencies and the "deconcentration" of State authority in France has led to a rather complex institutional context involving principally three types of '*collectivités territoriales'* or sub-national units of government (*communes, départments, régions*).[44] While decentralization has increased the responsibilities and competencies of local authorities, there is no direct federalism in the structure as found in other State-Region relationships in other Europe countries. As such, *there is no direct hierarchy between the different forms of sub-national authorities* (*régions, départements, communes*); rather each has its own assigned areas of jurisdiction with representatives of the Central government (regional and departmental *préfet*) to ensure the legality of actions.

3.1.1. Three Types of Authorities: Communes, Départements and Régions

The smallest form of government, the "*communes*," is the basic unit of state and political organization in France as well as the most numerous, currently numbering over 36,600 (corresponding to historical church parishes and ranging in size from less than 100 to several hundred thousand residents). The equivalent of incorporated towns or cities, the

[44] The election of François Mitterrand in 1981 marked the beginning of an intense period of action on the decentralization of authority and competencies to sub-national authorities. Making true on these election promises and a campaign based on expanding local administrative powers, President Miterand's Administration created much of the institutional framework that is still relevant today. Between 1982 and 1985, over 40 laws and 300 decrees treated a wide range of subjects: competencies, repartition of public resources, electoral rules and positions, modes of cooperation between local bodies and the development of participatory governance.

communes are typically responsible for all local-scale competencies except for those explicitly delegated or attributed to other governing bodies. Second, the 100 *départements* are the oldest type of local authorities, created first in 1780 and gaining their administrative status in 1871. Since 1982, the *départements* have equally gained the status of a local authority (*collectivité territoriale*) governed by an elected departmental council (*conseil general*) and a president elected from their midst. Since 1982 and the decentralization of competencies, the *département* is principally involved in the field of social policy, administering a number of aid and protection programs for children, mothers, the elderly and the handicapped. Finally, the 26 *régions* are the most recent sub-national authority formally invested with the majority of their modern powers in the 1980s. As a local authority, the *régions* are governed by an elected regional council (*conseil régional*) with a president elected from their midst. Principally, the *régions* act on issues of education (management of high schools), professional development, economic development and territorial planning and infrastructure development.

3.1.2. A Continued Presence of the Central State

While decentralized units have been created, the current institutional model in France attempts to retain the unity of the French nation under the control of the 'State' (*État*) through the presence of direct representatives of the national government at the different levels. Whether regional *préfets*, departmental *préfets*, or mayors (the only ones not appointed), these representatives are charged with the administration and implementation of State legislation as well as verifying, in many cases, that local decisions are coherent with State policy (Bonnard 2009).

3.1.3. Inter-communal Structures: Syndicats Mixtes, Communautés d'Agglomération and Communautés Urbaines

In addition to the vertical relationships between the central State and the different non-hierarchical sub-national actors, the last decades have seen the development of governmental units regrouping multiple communes. Demographic changes and the increasingly urbanized population have placed more importance on the ability of local authorities to manage effectively and efficiently a range of policy areas and the provision of public services. In this context, and given increasingly overlapping administrative boundaries, a number of formalized horizontal-governance relationships have been established in France. It is important to note that this has occurred without reducing the number of *communes*, but rather creating inter-communal structures for cooperation.[45] These inter-communal structures, generally termed as *établissement public de coopération inter-communale* (EPCI), take a number of different forms depending on their size as well as their modes of financing (see Annex X for a more detailed description).

Fiscally dependent EPCIs are 100% financed by member *communes* and other public entities. These contributions are set within the statutes and are typically based on criteria related to the services provided. While a number of fiscally dependent forms of EPCI exist,

[45] As the basic unit of French democracy as well as the long tradition of double mandates (a larger portion of Senators, Representatives and other members of the central State equally are mayors of *communes* and other sub-national governments), it has not been politically feasible to combine individual *communes*.

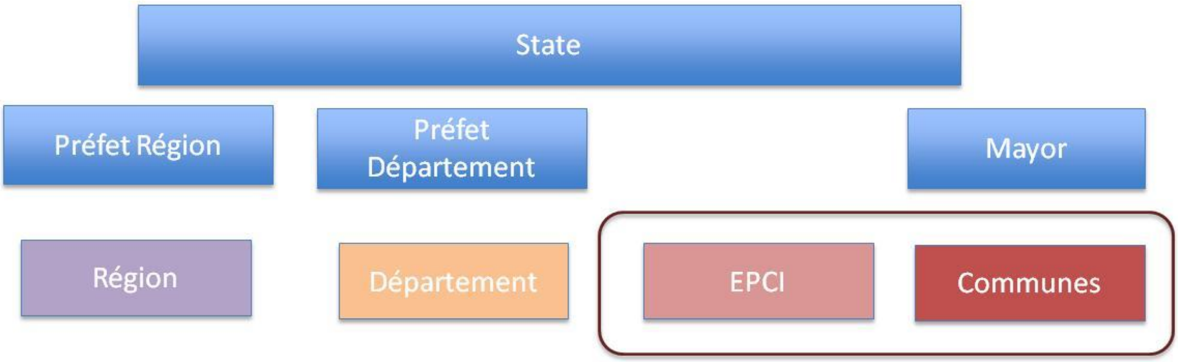
the most important in the transport sector is the *syndicat mixte*, based on legislation dating from 1935 and 1955. *Syndicat mixte* can federate together in a structure not only *communes*, but also include fiscally independent EPCIs (see below) and other *collectivtés locales* and public entities. These structures are dependent on members for finance and the establishment of their mission and objectives (typically addressing issues of water, waste, local development, energy, economic actions, education and culture, *tourisme*, etc). For example, a number of local authorities have chosen to create *sydicat mixte* to manage urban transportation, such as Grenoble-Alpes Métropole with the *Syndicat mixte de transports en commune* (SMTC).

Fiscally independent EPCI structures in France have become the most visible sign of institutionalized cooperation between *communes*. The creation of these EPCI not only transfers a number of jurisdictional competencies from the member *communes*, but also these structures can levy State-approved taxes on the populations, thus creating an additional level of taxation which allows for a measure of financial independence. In the cases of *communautés d'agglomération* and the *communautés urbaines*, the creation of these EPCI has equally led to new institutional organizations with executive bodies (president, inter-communal council) as well as the addition and fusion of administrative and technical services from the member *communes* making up the EPCI.

Communautés d'agglomération, such as Grenoble-Alpes Métropole, represent 7% (181) of these types of EPCIs, and 38% (approximately 22 million people) of the population and 9% (3,101) of *communes*. This form of inter-communality has been designed for medium-sized urban areas with a total number of inhabitations greater than 50,000 at the date of creation. Geographically, the *communauté d'agglomération* must be organized around a 'core' *commune* with more than 15,000 people. *Communautés d'agglomération* are required to assume jurisdiction over a number of competencies, including economic development, spatial planning, social-housing policy, and urban-social policy, as well as a number of optional competencies, including community-wide interest infrastructure (*voirie*), sewer, water, environment, waste (solid), sport and cultural facilities.

While in 2010 *communautés urbaines* represent only 1% (16) of the fiscally independent EPCIs and regroup only 1% (413) of *communes*, they regroup 13% (approximately 7.6 million people) of the population. *Communautés urbaines*, such as Nantes Métropole, are the most integrated form of inter-communal structures from which, once created, individual *communes* cannot vote to leave. Further, the C.U. is responsible and has direct control of a wider range of policy competencies. *Communautés urbaines* were designed to manage the public services used at the scale of the urban area as well as the other network services, such as road/rail, transports, water and sewers, and must assume complete control of required competencies from member *communes*. These include economic, social and cultural development of the community; spatial planning and development; social-housing policy; management of community services and facilities; and environmental protection and quality of life.

Figure 10 : Institutional Hierarchy in France (representatives of the State in blue)



3.2. Institutional Context for Urban-Passenger Transport Governance: between Transport Policy and Urban Planning

In France, the principal mandate for local-scale development is linked to the concept of *aménagement du territoire* or territorial development. Seen as both a process and a result, this concept dates from the 1950s in France and is linked to the economic and social development of the French territory with the objective of achieving an efficient, equitable distribution of population, resources and economic activity. Historically, this process has been highly centralized and led by the State. However, the process of decentralization and development of inter-communal structures, the principal legislation dictating the legal framework for urban development and transport policy, has undergone significant changes since the 1980s. Often, what could be characterized as a "push-pull" relationship between the two issues as a desire to establish the proper territorial perimeter has been eclipsed by the desire to achieve better cross-sector coordination, and vice-versa (Offner 2002). At the heart of this matter has been a reformulation of institutional structures to reflect the modern demands of urban development and transport planning better.

It is important to note that, as is the case for most capital cities, Paris and the Ile de France region falls outside of the legislative and regulatory structure described below (given politicization, economic weight as well as concentration of the population). A specific legal framework exists for the management of Ile de France (Paris) and is, thus, not treated in this chapter.

3.2.1. Distribution of Competencies for Transport and Urbanism: Overlapping Authority with Limited Hierarchy

Since the 1980s, the decentralization process in France has distributed the competencies for transport and urbanism across and between the different levels of governance. In terms of transport policy, starting with the 1982 with the "*loi d'orientation sur les transports intérieurs* "(LOTI) (see Annex 4 for a detailed presentation of the different pieces of legislation), different local authorities have been designated as the *Autorités Organisatrices de Transports* (AOT)[46] for rail, rural and urban-transport services (see Table

[46] Entities charged with the organization and management of transportation services within a defined perimeter.

16).[47] Further legislation, including the landmark "*Loi sur l'air et l'utilisation rationnelle de l'énergie du 30 décembre 1996*" (LAURE) responded to the growing concern about energy use and local air pollution in the 1990s. As such, a stated goal of local transport policy has been the priority of developing and favoring the use of transport alternatives to the use of personal vehicles as well as reducing energy consumption. This has been further reinforced by later legislation, including the "*La loi Solidarité et Renouvellement Urbains*" (SRU) in 2000 and the *Grenelle de l'environnement* in 2010, which has established a target of reducing GHG emissions from all sectors by 20% of 1990 levels by 2020.

Table 16 : Distribution of Transport Competencies

	State	***Région***	***Département***	***Commune* & EPCI**
Managing Authority (AOT)	- Inter-regional rail, high-speed rail (TGV)	- Regional road and rail (TER)	- Non-urban road (buses, etc.)	- Urban (AOTU)
Infrastructure	- National roads and railways		- Departmental roads - Portion of national roads	- Communal roads - Urban public transport
Planning Documents	- *Schéma national des infrastructures de transports*	- *Schéma régional des infrastructures et des transports* (SRADT)	- *Schéma départemental de transports* (SDDT)	- *Plan de déplacements urbains* (PDU)

Legislation and regulations concerning urbanism in France are grouped together in what is called *Code de l'Urbanisme*. Initially created in 1954 in its present form, it lays out the objectives, distribution of competencies, regulations and processes corresponding to urban development. Within the *Code*, the objectives that the various planning tools and documents must respect are also outlined (*l'article L. 121-1*), including : 1) balancing urban development with the preservation of rural and natural areas; 2) diversity of urban functions and social mix in urban and rural housing; 3) an efficient and balanced use of natural, urban, suburban and rural spaces, controlling the needs of mobility and traffic, preservation of clean air, as well as prevention of foreseeable natural and technological hazards, pollution and nuisance of any kind. Since the mandating of the development of the original *schéma directeur*[48] planning documents in 1967, the most significant modification to the *Code de l'urbanisme* in France occurred in 2000 with the *loi relative à la solidarité et au renouvellement urbains* (SRU). This legislation greatly modified the *Code d'urbanisme* in terms of planning, replacing the *schema directeurs* (SD) with the *schémas de cohérence territoriale* (SCOT) planning documents. Further, less-coherent *plans d'occupations de sols* (POS) land-use plans were equally replaced with the currently-used *plan local d'urbanisme* (PLU).

[47] It is important to note that individual *communes* and inter-communal structures can choose to manage transport planning and operations themselves (the case of Nantes-Métropole), or can delegate the competences of the AOT to a *Syndicat Mixte* (as in the case of Grenoble Alpes Métropole and the *Sydicat Mixte de Transports en Commun* (SMTC)).

[48] Created in 1967, the *Schéma Directeur* set the strategic direction of the territory concerned and determined the long-term general land-use planning.

Table 17 : Distribution of Urban-Planning Competencies

<table>
<tr><th></th><th>State</th><th>Region</th><th>Department</th><th>Commune & EPCI</th></tr>
<tr><td>Division of responsibility</td><td>- Projet d'intérêt général
- Opération d'intérêt général
- - Directives territoriales d'aménagement</td><td>- Oversight of coherence with national policy
- Development contracts
- EU structural funds</td><td>- Rural infrastructure and material</td><td>- Authorize land use, building permits*
- ZAC-Zone d'aménagement concerté</td></tr>
<tr><td rowspan="2">Planning Documents</td><td rowspan="2">- Verification of legality of planning documents (SCOT, PLU, etc;) through préfets</td><td>- Schéma régional d'aménagement et de développement du territoire (SRADT)</td><td></td><td>- Plan local d'urbanisme (PLU)*
- Plan local de l'habitat (PLH)</td></tr>
<tr><td colspan="3">- Schéma de cohérence territoriale (ScoT)</td></tr>
<tr><td colspan="5">* The authorization of land use, building permits as well as the PLU remains under the direct control of the mayor unless delegated to the EPCI. The only exceptions are in the case of the PLUs of the early communauté urbaines of Bordeaux, Lille, Lyon and Strasbourg, which are directly under the control of the urban community government.</td></tr>
</table>

Given that the process of urban development and planning includes a large number of choices, from the construction of public facilities to the private housing developments, it can be difficult to chart the distribution of the competences related to urban planning and the larger process of *aménagement* clearly. However, as shown in Table 17, a number of responsibilities for both actions and planning documents are delegated to specific authorities. While the State, *régions* and *départments* are involved in the development of a limited number of projects, the *communes* in France retain the majority of control over decisions concerning land use, building permits and operational urbanism. In the majority of instances, even when *communes* are engaged in an inter-communal structure (EPCI), they continue to have direct control over the *plan local d'urbanisme*, the only legally binding urban-planning document.[49] The responsibility for the elaboration of the *schémas de coherence territoriale* (SCOT) falls upon all sub-national actors, as its development is led by an agency headed by representatives from all involved parties (*régions, départments and the communes/EPCI*). Beyond establishing the larger planning framework used across levels, the State plays a role principally through national regulations and standards impacting urban development as well as assuring that planning documents are coherent with national legislation.

3.2.2. Financing: High Levels of Local Participation and Autonomy

In France, the financing of activities is closely linked to the level of government at which the competency is held. The financing of transport infrastructures and public transport in France stems from a number of different sources, including: the *versement transport*; tariff

[49] It is important to note that in a specific instances (*communauté urbaine* created before the SRU or when specifically delegated), the PLU may be elaborated by the inter-communal structure. However, the PLU continues to be principally elaborated by the individual communes with, when available, assistance from other (inter-communal, etc.) structures.

revenues; different subsidies; *dotations*[50]; and debt. A particularity of the French system and by far the largest source of financing for both transport operations as well as investment comes from the *versement transport,* a tax paid by local businesses larger than nine employees based on total payroll in urban areas with over 10,000 residents. Collected by the EPCI and managed by the AOTU, this block of funding has given local governments a significant margin of autonomy in developing and approving transport projects.

Table 18 : Financing of urban passenger transport (operations and investment) outside of Ile de France 2000-2002 (in Million Euros)

	2000		2002	
Ticket Revenues	703	16.4%	712	17.4%
Versement Transport	1,696	39.6%	1,844	45%
Local Budget	723	16.9%	716	17.5%
State Transfers (État)	291	6.8%	172	4.2%
Other (loans included)	868	20.3%	651	15.9%
Total	4,281	100%	4,094	100%

Source: Cour des comptes 2005:143

The financing of urban planning and development is complex and less direct, combining a number of public and private sources. In addition to the financing invested by private developers in residential and commercial projects, there are a number of public sources of finance. A large number of infrastructure investments fall under the categories of specific policy tracks (health, education, transport, public housing, etc.) for which there is a dedicated budget. Nevertheless, a number of financing and subsidy programs exist, either through the auspices of the European Union and the different financial instruments (ERDF, JESSICA[51]) or through the French State, such as the development of *Contrats de Plan État-Region* and *Contrats de Ville*. These competitive project-based programs, however, are limited in scope and, thus, provide funding to only a relatively small number of projects. Historically, local authorities have also had access to a number of local taxes to allow them to leverage financing, such as the *taxe foncière sur les propriétés bâties*, representing 30% of local revenues, levied on owners of constructed properties and the *taxe foncière sur les propriétés non bâties*; less than 2% of tax revenues, it is levied on un-built properties (Bonnard 2009). However, it is unclear what portion of these different taxes serve to finance the operations of the local authority and what portion are re-invested into urban-development projects.

3.2.3. *Le mille feuille administratif*: a Culture of Planning and Strategy Documents

A principal component of transport and urban-planning policy in France is an interrelated system of statutory and strategic plans. Together, these documents aim to

[50] The second specificity to the French context are national transfers, or '*Dotations*' from the central State to local authorities to cover a portion of the costs of implementing the responsibilities delegated through the decentralization process. While these transfers may make up a significant portion of the budget for other policy sectors, they represent only a relatively small amount of funds for transport development outside of Ile de France (Paris) in France.

[51] ERDF- European Regional Development Fund; JESSICA - Joint European Support for Sustainable Investment in City Areas

establish a “unified” approach, theoretically coordinated by the principal directives set forth in the SCOT document developed at the scale of the urban area (*aire urbaine*)[52]. These documents attempt to balance the over-arching priorities of sustainable development including economic, social and environmental elements, while at the same time encouraging citizen participation in their development and implementation. While rational in its approach, this system has been named the *mille feuille administratif* (administrative layer cake) due to the resulting mass of strategic documents and the difficulties often encountered in their coordination and implementation.

Urbanism: SCOT, PLU

The two principal planning documents in terms of urbanism are the *schémas de cohérence territoriale* (SCOT) and *the plan local d’urbanisme* (PLU). These two documents have strategic importance for the territory within their boundaries, setting the development priorities and principal objectives. However, they have two very different roles that must be kept in mind. Firstly, the SCOT is developed at the scale of an entire territory / metropolitan area and is used to establish a shared vision between the different local authorities (principally *communes* and the different inter-communal structures). The documents serves to establish a certain number of over-arching objectives in terms of housing and social housing, urbanization and public transport, the protection of landscapes, as well as risk prevention. As such, it serves to coordinate the different communal and sectoral-planning documents (PLU, PDU, PLH etc.) within its perimeter, focusing specifically on urbanism, transport, housing and the localization of commercial facilities.

At the most local level, the *plan local d’urbanisme* (PLU) sets the binding objectives and regulations in terms of land use at the level of the *commune*. While it must be coherent with the SCOT, the PLU formalizes land-use regulations and other details of the operational development practices. It serves as the only *legally binding*[53] reference for land use, project approval and the subsequent issuance of building and demolition permits.

Transport: PDU

The *plan de déplacements urbains* (PDU)[54] principally addresses issue of urban transport. Established by the LOTI legislation of 1982 and subsequently detailed with the LAURE (1996) and SRU (2000) (See Annex 4), the PDU is elaborated every 10 years. The PDU serves to organize passenger transport and freight traffic and parking within an officially

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[52] It should be noted that these different documents do not necessarily represent a linear development (SCOT -> PDU -> PLU -> PLH) as they have been created and implemented at different moments in time and require different approval processes that can introduce delays, etc.

[53] While there is a legal obligation to produce the other documents, such as the SCOT, PLH, etc., the PLU is the only legally binding document that can be used to contest the granting of different building permits, etc., in a court of law.

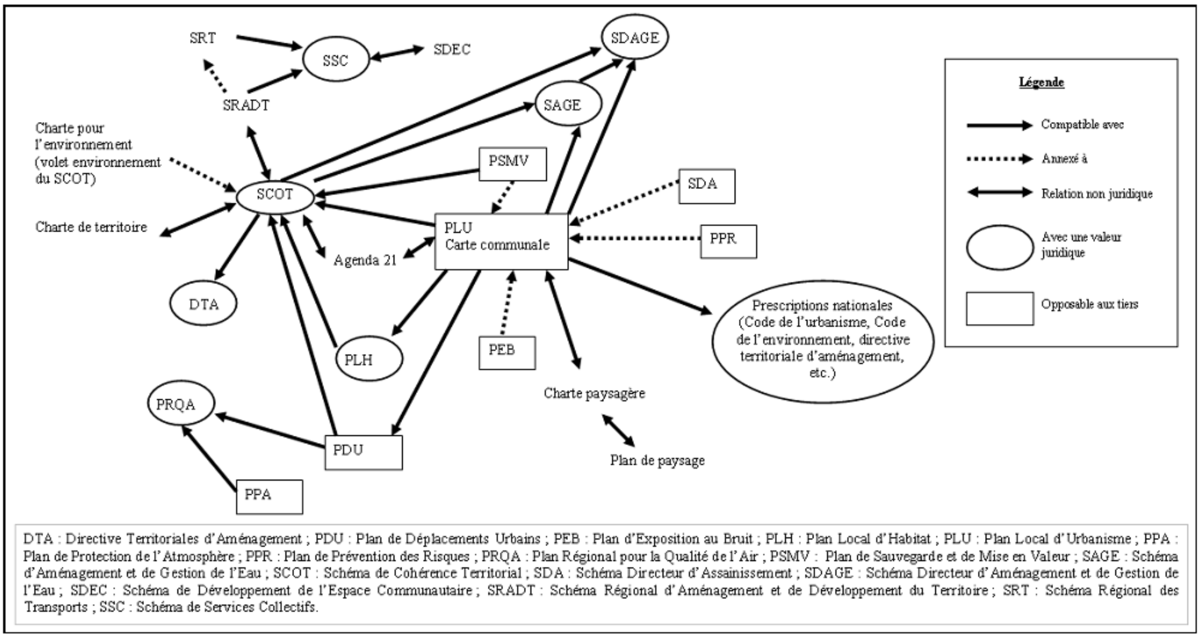
[54] PDUs are statutory for urban areas larger than 100,000 residents and are developed by the *Autorité Organisatrice des Transports Urbains* (AOTU - *Urban Transport Organizing Authorities*), typically the inter-communal structure that is vested with the competency for urban transport. In 2008, 72 urban areas with populations above 100,000 residents were required to produce PDUs with an additional 43 choosing to do so voluntarily (GART 2010).

recognized perimeter (PTU)[55]. The objectives of the PDU include improving the safety of all trips, reducing personal-vehicle traffic, and the organization of parking as well as promoting cleaner and energy-efficient modes.

Compatibility, Coherence and Other Planning Documents

A final point important to understand the relationship between the planning documents is the legal concepts of *compatibilité* and *cohérence*. In French legal terminology, the requirement for documents to be *cohérent* implies that the documents must implement similar planning practices; however, one document does not impose itself on the other. *Compatibilité* however, requires that the other documents comply with the norms and standards set out in the over-arching document.

Figure 11: Relationships between planning documents in France



Source: Colombert 2008

The above strategy and planning documents make up only a small portion of the larger planning culture often referred to as the *mille feuilles* (thousand layers). As seen in Figure 11, the SCOT, PLU and PDU have a complex relationship with the various other statutory and voluntary planning and orientation documents in France (see Annex 4 for more information). Given that a number of these transversal planning documents have been created at different points in time and that they are updated at different rhythms, ensuring coherence and compatibility, as well as a clarity of objectives, can be challenging in practice.

3.2.4. Layering in Additional Actors in Transport and Urbanism: Obtaining an *image d'ensemble*

In addition to the State, the *Régions*, the *Départements* and the *Communes*, a number of other actors are involved in both transport and urbanism. These bodies assist national and

[55] The scope of the *Perimetre de transports urbains* is established at the scale of the organising entity (*commune*, inter-communal structure, *sydicat mixte*) and approved by the *préfet.*

local authorities in the development of planning documents, projects, as well as socio-economic and environmental evaluations. At the national level, a number of centralized agencies and ministerial bodies are involved in transport and urbanism: DGITM - *direction générale des infrastructures, des transports et de la mer*; CERTU - *Centre d'études sur les réseaux, les transports, l'urbanisme et les constructions publiques*; ADEME-*Agence de l'environnement et la maitrise de l'energie*[56]; DATAR - *Délégation interministérielle à l'aménagement du territoire et à l'attractivité régionale.*[57] Secondly, a number of "decentralized" bodies have been created to provide technical support to local authorities in the development of plans and projects, including CETE-*Centres d'études techniques de l'Équipement* (eight interregional centers in France); DREAL– *Directions régionales de l'environnement, de l'aménagement et du logement*. Finally, a number of non-governmental and private entities are equally involved including Urban planning agencies (*Agence d'urbanismes*); AASQAs (*Associations agréées de surveillance de la qualité de l'air)*[58]; private companies-consultancies (studies, transport and urbanism plans); public / mixed / private operators; and public / mixed / private real-estate developers.

Layering in these additional actors with the larger institutional framework, it is possible to characterize position and role of the constellation of actors involved in the urban passenger transport governance in France. Figure 12 and Figure 13 present the decision-making arrangements around the PDUs for Grenoble Alpes Métropole and Nantes Métropole. As seen in these figures, a large number of actors play a role in providing mandates, financing, technical assistance as well as the necessary expertise. Further, the institutional arrangements are similar, but not always identical, particularly between a *communauté d'agglomération* (Grenoble Alpes Métropole) and a c*ommunauté urbaine* (Nantes Métropole). Adding an additional layer of complexity in the case of Grenoble Alpes Métropole is the historical delegation of transport management (AOT) to a *syndicat mixte*, controlled jointly by the *département de l'Isère* and the *communauté d'agglomeration* (further discussed below).

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[56] N.B. The ADEME has both a centralized and decentralized presence with National offices as well as Regional Directions present in the *Régions* who work directly with the *collectivités*. The D.R. (define/explain) also play a role in the CPERs established between the central government and the regions.

[57] The DATAR is the French administration responsible for preparing guidelines and implementing national policy on land-use and development planning. It is particularly involved in the implementation of decisions adopted by the *Comité interministériel d'aménagement et de développement du territoire* (CIADT).

[58] The AASQAs are often active in the collection of data on atmospheric pollution stemming from transport and other sources.

Figure 12: PDU Decision-Making and Transport Operation in Grenoble Alpes Métropole

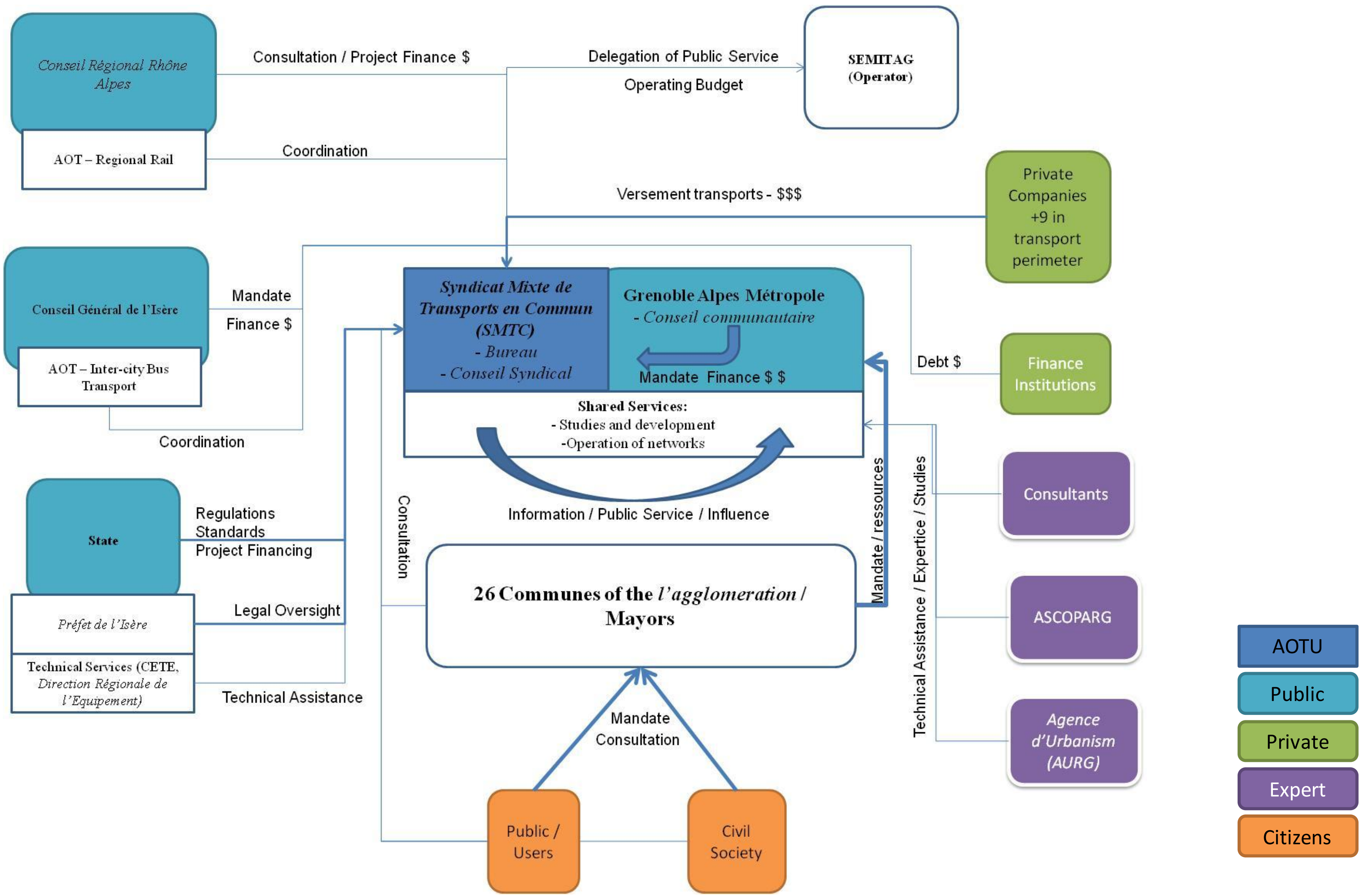
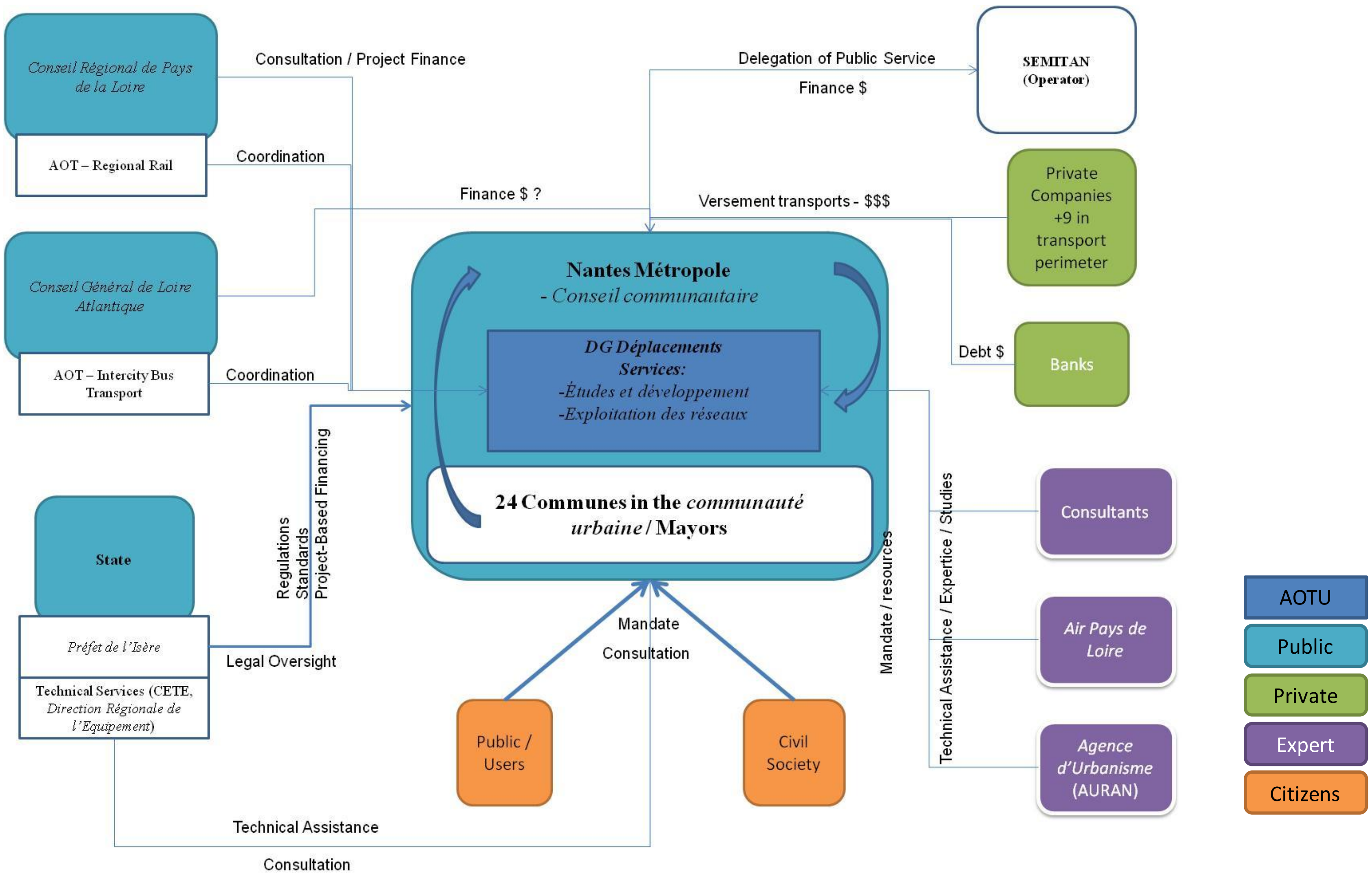


Figure 13: PDU Decision-Making in Nantes Métropole



As seen in the above section, the legal context for transport and urbanism planning and implementation in France is characterized by a large number of often-overlapping documents elaborated across multiple levels of government. While heavily decentralized, with *communes* and inter-communal structures playing an important role in the development of both PDUs and PLUs, the State as well as the *Régions* and *Départments* continue to play important roles in shaping policy. National mandates, as well as the key roles that other levels of government hold in terms of transport competencies, require coordination between levels to achieve integrated planning. Nevertheless, inter-communal structures have a significant source of autonomy in terms of transport planning and development, thanks to the *versement transport*, an important source of financing representing close to 50% of funds used for investment (2002) as well as a portion of operation costs. However, financing in and of itself does not guarantee success in terms of achieving transport- and urbanism-policy objectives, particularly when environmental concerns are increasingly layered into a large number of existing economic and social objectives. Given the existing mandates, achieving emission reductions in the urban passenger transport sector is France appears to be more about doing existing actions "better" than changing course radically. As such, coordination of action and actors aligned with similar objectives, including the reduction of GHG emissions, appears to be an important objective. The following section will attempt to identify the institutional barriers limiting local authorities in France in achieving the reduction of greenhouse gas emissions in the urban passenger transport sector.

4. INSTITUTIONAL IMPACTS ON GOVERNANCE: FRAGMENTATION AND LIMITATIONS

Drawing on a multi-level-governance framework allows for the identification of barriers to local-scale action within this institutional context. Recent work by Charbit and Michalun (2009) and Charbit (2011) have identified a number of "gaps"[59] which can result from the macro, multi-level context. Once recognized, these "gaps" can potentially be overcome through the modifications of institutional arrangements or the use of different policies, such as contractual tools, as the majority of these "gaps" stem from issues of coordination and capacity challenges (Charbit and Michalun 2009). However, there is no "optimal" solution to overcome these challenges, as both macro- and mico-contextual variables are important (Charbit and Michalun 2009; Foster 1999; Poteete et al. 2010).

Drawing on the institutional context for the governance of urban-transport policy and urbanism described above, as well as case studies conducted in Nantes Métropole and Grenoble Alpes Métropole, the following section explores how the institutional context

[59] Administrative gap: geographical mismatch between policy issue and administrative boundaries; Policy gap: sectoral fragmentation of issue-related tasks across ministries and agencies (also at the local scale between different entities); Objective gap: Different rationalities creating obstacles for adopting convergent targets; Capacity gap: Insufficient scientific, technical, and implementation capacity on the part of local issue management actors (size and quality of the infrastructure and resource they must manage); Funding gap: Unstable or insufficient revenues undermine effective implementation of issue responsibilities at sub-national level; Information gap: asymmetries of information between policy making and/or implementation authorities and between public and non-governmental actors; Accountability gap: Difficulty to ensure the transparency of practices across the different constituencies.

influences governance of transport and urbanism. This section will conclude with an analysis of how each gap can reduce the ability of local authorities to implement the policies necessary to address greenhouse gas emissions from the passenger-transport sector.

4.1. Governing a Fragmented Context

As seen in the above section, the institutional context in France creates a fragmented environment. The following section explores the effects of this fragmentation, looking at divisions between perimeters of action, jurisdictional competencies, policy frames and objectives, as well as finances.

4.1.1. Fragmentation across Jurisdictions: Conflicting and Overlapping Perimeters of Action

One of the principal sources of fragmentation is the mismatch between issue and administrative boundaries, linked principally to issues of *size and overlap.*

Size

In terms of size, the perimeter of the planning documents is either too small or too large to address the policy problem completely. For example, the perimeter of the PLU or the PDU may not extend beyond the limits of the EPCI and, thus, not be able to influence directly the suburban areas where a substantial portion of current growth is occurring. While suburban *communes* may be elaborating PLUs (urbanism), in most cases they will not be covered by a PDU. The perimeter at which transport policy is formulated (PTU) is further complicated as it rarely covers the entire commuting area. In the case in both Nantes and Grenoble metropolitan areas, the PTU encompasses 27 *communes* while the urban area is defined as the 198 *communes* around the Ville de Grenoble, and 24 vs. 82 communes in the case of Nantes (INSEE 2009). Further, since the transport perimeter (PTU) is used as the perimeter of the *versement de transports* (the principal funding mechanism), there may be a loss of revenue as only those companies within the PTU pay, even if they or their workers use the urban-transport infrastructure. Finally, in both Nantes and Grenoble it was noted that in some instances *communes* that play a role in the management of transport were not included within the perimeter, while others that have little impact fall within the jurisdiction of the AOTU. This is often linked to the political nature of how perimeters are established.

A second difficulty related to size has been identified in cases where the jurisdictional perimeter is too large either in and of itself or in relation to related planning documents. For example, the SCOT in Grenoble metropolitan area brings together 273 *communes* with a combined population of over 730,000 inhabitants and includes multiple inter-communal structures. Interviewees questioned whether it was feasible to organize a coherent planning vision over such a large area, particularly when some of the *communes* in the Grésivaudan area have a closer connection to the greater Lyon urban area than that of Grenoble. The size of the perimeter may also pose difficulties in terms of downscaling from a large-scale, general planning document to a detailed PLU or even PDU at the scale of the EPCI or *commune* as the translation of general-planning guidelines into concrete actions is required.

Table 19: Administrative Perimeter Fragmentation

Size	- boundaries too small - boundaries too large
Overlap	- between adjacent planning documents - between documents for different sectors

Overlap

The often-limited size of the different administrative boundaries also creates a situation where cooperation is required between multiple, discreet authorities to cover most or all of the urbanized or commuting area. This requirement for coordination between authorities can create situations where both informal and formal ties must be made between bordering *communes*, inter-communal structures and/or requiring multiple AOTs to work together. For example, in the case of Nantes Métropole, only 57 *communes* of the estimated 82 in the larger urban area are included within the perimeter of the SCOT (INSEE 2009). As Nantes Métropole itself is located close to the southeast boundary within the SCOT perimeter, a portion of the urban and the community area spills into area covered by the SCOT of Pays de Vignoble Nantais (Figure 14). This poses difficulties, since not only are no formal coordination mechanisms in place, but also the development of the two SCOTs is at different stages of progress.

Figure 14: Greater Nantes Urban Area and the Perimeter of the SCOT (in green)

Source: Scot. Métropole 2010

A similar difficulty concerning both the size of the perimeter and the need for coordination is the significant differences in the perimeter of the different planning documents. As seen in Table 20, each of the planning and orientation documents functions at a different perimeter, often at vastly different scales (ranging from 273 to one *commune*). While, as explored further below, the difference in perimeter often corresponds to the jurisdictional boundaries of the vested institutional body, differences in perimeter can cause difficulties in coordinating between multiple documents with overlapping boundaries that often do not match the boundaries of either transport or urbanism.

Table 20: Perimeter of Planning Documents in Nantes and Grenoble

	Grenoble	Nantes
EPCI (2006)	27 *communes* 397,345 inhabitants (2006) 307.1 km²	24 *communes* 580,503 inhabitants 523.4 km²
Urban Area (INSEE 2006)	199 *communes* 531,439 inhabitants 1 567.9 km²	82 *communes* 768,305 inhabitants 2 242.64 km²
PDU	27 *communes* of the CA 397,345 inhabitants 307 km²	24 *communes* of the CU 580,503 inhabitants 523 km²
SCOT	273 *communes* 730,300 inhabitants 3,640 km²	57 *communes* (5 EPCI) 760,000 inhabitants; 1,660 km^2
PLU	Each *commune* (27 separate documents)	Each *commune* (24 separate documents with centralized assistance from the *Communauté Urbaine*)

Sources: INSEE 2006; EPSCOT 2010; Scot. Métropole 2004; AURAN and Nantes Métropole 2010

4.1.2. Fragmentation of Responsibilities between Actors

Policy gaps address the sectoral fragmentation of issue-related tasks across ministries and agencies as well as between different institutional entities at local scales. This is directly related to the policies dictating the distribution of required and optional jurisdictional competencies both between and within local, regional and national entities. As seen in Table 16 and Table 17, above, the legal framework for transport and urban planning in France dictates the competencies to be assumed by the different authorities. Additionally, different forms of EPCI hold different competencies and can choose among a number of optional competencies transferred from the included *communes*. While the transport jurisdictional competency is held in both the case of *communautés urbaines* and *communautés d'agglomération* by the EPCI, other competencies, such as development and maintenance of road infrastructures, can limit the scope of action available. Further, this fragmentation of policy competencies across institutions can be further complicated by the fragmentation of responsibility within authorities between different departments and services, thus increasing the potential difficulty in coordinating policies within and between the transport and urbanism sectors (Figure 20).

Table 21: Fragmentation of Responsibilities between Actors

Distribution within sectors	- Across institutions (within and between levels) - Within institutions
Distribution across sectors	- Across institutions (within and between levels) - Within institutions

The fragmentation within a single sector can cause significant difficulties both across and within institutions to coordinate the key elements necessary to achieving changes in modal distribution, thus increasing density or limiting urban sprawl. For example, the fragmentation of competencies for transport between different institutions (State, *Région*, *Département*, EPCI and *Commune*) may limit the capacity of actors to organize a multi-modal passenger-transport offer. As seen in Table 22, different institutions are responsible for different modes, thus posing challenges for integrating regional rail, bus and tram service. For example, Nantes Métropole has encountered difficulties in coordinating the Lilla departmental bus service, as well as further developing a regional rail system, due partially to the need to coordinate with the *région* Pays de la Loire. While in some instances these difficulties to coordinate may stem from differences in objectives as explored further below, they can equally stem from a lack of capacity at the scale of the *région* and *département* to develop multiple projects across their territory, even when a commitment is found locally. In Grenoble, a different issue has been identified in the difficulties that the Métro has encountered in attempting to oversee the SMTC, a partially independent agency that has been delegated the responsibility for organizing public transport as the AOTU. As such, the Métro is at times limited in its ability to control the development and implementation of the PDU and transport policy.

Difficulties are equally encountered when specific competencies with local impacts are held at higher, often detached, levels of government. Furthermore, a problem cited by many is the classification of parking violations as a penal issue, and, thus, falls under the control of the State (set unilaterally at a very low amount). As such, local governments are unable to use an important tool to incentivize behavioral change.

The fragmentation of competencies across institutions also occurs in terms of urban planning. Equally visible in Table 22, responsibility for different planning documents and actions are held by different institutions requiring a significant cooperation and coordination for success. Given that the mayors of the communes hold principal responsibility for developing as well as implementing PLUs, the only legally binding planning document (see above), it is imperative for the institutions responsible for the SCOT and other planning documents to ensure the translation of larger objectives and priorities into individual actions. This is even more important given that mayors hold the operational-urbanism competencies (building permits, etc.).

Table 22: Distribution of Competencies across Institutions

	Nantes Métropole	**Grenoble Alpes Métropole**
Transport		
TER - Regional Rail	*Pays de la Loire*	*Rhône Alpes*
Intercity Bus (car)	*Département Loire-Atlantique*	*Département de l'Isère*
Urban Transports (AOTU)	- *Nantes Métropole-Direction Générale Déplacements*	- *Sydicat Mixte de Transport en Commun* (SMTC) - *Service mobilité et transports de la Métro*
Operators	SEMITAN; SNCF;	SEMITAG; SNCF;
Urbanism		
SCOT	*Sydicat Mixte du SCOT*	*Etablissement Public du SCOT*
PLU	*Communes*, with oversight from the *Service d'urbanisme of the Communauté urbaine*	*Communes*
Operational Urbanism	EPCI	EPCI
Building Permits	*Communes*	*Communes*

Fragmentation of policy competencies equally occurs within governing institutions at all levels. Whether between State-level ministries, agencies or departments and services, this separation can lead to a lack of coherence on subjects, such as transport and urbanism, which often require coherent transversal action. At the national level, this occurs not only in terms of division of competencies between the *Délégation interministérielle à l'Aménagement du Territoire et à l'Attractivité Régionale* (DATAR) and the *Ministère de l'Écologie, du Développement durable, des Transports et du Logement* (MEDDTL), but also within their individual services. This can particularly be the case when coordination *between sectors* is necessary, thus the coordination of transport and urbanism policy. As this transversal coordination often requires the participation of a range of different departments and services, numerous obstacles can arise. Not only are these actors often working towards diverse objectives set by separate services and have different framing of the issues, as will be explored below, but they are also equally dealing with separate codes for building, urbanism and the environment with often little direct relationships between them (Pezet-Kuhn 10.03.02). Further, the coordination of planning documents focusing particularly on specific sectors can be challenging if representatives from different agencies and divisions are not able to participate actively from the start.

4.1.3. Fragmentation of Objectives and Accountability: Competing Definitions of Problems and Solutions

Given the broad range of actors needed to coordinate urbanism and transport policy, it is not surprising that different rationalities can create obstacles to adopting convergent targets. Attempts to coordinate actors with divergent framings of the subject as well as goals can inhibit the development of an "integrated approach" through which the synergies between transport and urbanism can be fully exploited. As seen in Table 23, these differences in objectives can stem from differences in priorities of actor groups, but also from the larger systemic differences in how professional cultures frame issues and policy solutions. In general, France is marked by a segmentation of the engineering culture by subject areas, which can influence how different professions frame and view subjects (Poimboeuf 10.03.01; Pezet-Kuhn 10.03.02). Thus, wide differences in terms of how the policy problem to be solved and the appropriate solutions to apply can occur.

Table 23: Fragmentation of Objectives

Separation of Professional Cultures	- Different framing of issues - Different measures of policy success
Varying Priorities and Preferences	- Technical staff - Elected official - Expectations of the general public

Technical Staff

Both transport and urbanism can be framed in very different ways, and, thus, similar issues can have different objectives depending on what approach is being used. While reductive and evolutions in behavior have occurred, this simplified characterization can be said that those approaching the subject with an urban planning perspective take a more "holistic" or systemic approach, whereas transport engineers often take a more "project-based" approach. For example, in the Grenoble Alpes Métropole area, the process of increasing density within the urban area is seen as a means of achieving multiple objectives and, thus, framed differently depending on professional cultures. For both transport and urban planners, increasing density and mixed-use is seen as a means of reducing urban sprawl, reducing transport demand across the entire urban area as well as producing a better balance between the localization of employment, services and housing (Grange 10.03.02). However, for urban planners, this must be done in a way that continues to make the agglomeration livable and attractive, including limiting the exposure of the population to pollutants. While transport engineers also emphasize the need to increase density, this stems from density as means for rendering different technical solutions feasible. As such, densification is concentrated along existing or projected transportation axes in order to increase demand for mobility services within that area. While this is not antithetical to the objectives of urban planners, there is less of a holistic approach in terms of other objectives, such as reducing exposure of the population to pollutants as these tend to increase along transport corridors, etc (Kuhn-Petzet 10.03.02). As such, in both Nantes and Grenoble, highs and lows have been noted in the relationships between those services dominated by an urban planning perspective and those services dominated by transport engineers, often due to differences in framing objectives and solutions.

These differences in framing and objectives can be linked to the priorities and preferences of the different actors involved, and thus influenced by how success is measured and to whom actors are accountable. Transport engineers tend to conceptualize transport-related objectives in terms of passenger-kilometers, number of trips, length of trips, number of available seats and total network capacity, etc. These indicators focus principally on the transport network and individual technologies and projects, rather than the impacts on the larger urban environment. Urban planners tend to use more “macro” measures of overall density, production of housing, global transport demand and impacts on the real-estate markets. As such, the scales at which the two professions focus may lead to difficulties in establishing common objectives, as one tends to focus on individual technical solutions while the other attempts to address the larger system. For example in Grenoble, when addressing climate change, transport engineers typically focus on technical solutions to reduce emissions rather than directly addressing the larger problems of continued increases in energy demand, no matter its method of production (Uhry 10.10.20).

Elected officials

While understanding the barriers caused by differences between professional cultures among the technical staff, it is equally important to understand how the choices concerning objectives held by elected officials can influence transport and urbanism. First, while the legislative framework in France requires that energy and emissions are taken into consideration in transport planning (LAURE legislation), it is up to elected officials to make this a priority or simply a further constraint that will be treated minimally within the decision-making process (Gusmeroli 10.03.01). In decisions concerning transport and urbanism, there are important financial elements concerned beyond issues of investment costs. Suburban development can lead to the creation of potentially important tax bases for the *communes* bordering larger urban areas. Further, different tools, such as parking, etc., are periodically perceived as an opportunity to leverage funds for the local authority; as such, the number of parking spaces may not be limited in central areas in order to increase revenues (LeGal 10.12.08). While this does not mean that elected officials have not acknowledged the need of balancing modes and improving mobility conditions within the urban area, (Herbreteau 10.12.07), their framing of the subject can influence policies that are put into place. For example, while elected officials in Grenoble recognize the need to develop public transport and have put significant effort and resources into supporting policies, the perception of attractiveness and economic competitiveness of the region is framed as a need to ensure accessibility by personal vehicles (Poimbeouf 10.03.01). As such, policies aiming to reduce personal-vehicle road space, parking and access are often highly contested. Further, the indicators most used by elected officials to measure the success of transport policies are first, the frequency of public transport, followed by issues, such as the impact of a tramway project or the renovation of a street (access to parking, road space distribution, quality of urbanism), etc. (Gusmeroli 2010). Thus, short-term and directly tangible impacts appear to be more highly valued over medium- to long-term costs or benefits, particularly given their ability to be used within relatively short election cycles (five years).

Expectations of the general public

Finally, it is equally important to look at the objectives of the general population. As achieving changes in both transport and urban-planning policy, as well as reducing greenhouse gas emissions requires modifications in the behavior of individuals (Gusmeroli 10.01.05), it is important to understand how these issues are framed. Often, limits on the use of personal vehicles and moves towards densification are perceived as constraining individual liberty and as going against expectations of individuals in terms of quality of housing, transport and life (Grange 10.03.02). As such, elected officials often do not risk asking the general population to make significant changes in their behavior (Gusmeroli 10.01.05) due to potential popular opposition.

These different means of framing transport and urbanism, as well as the further integration of greenhouse gas emissions, can lead to differences in approach and definitions of objectives, as well as the appropriate means of achieving them. As such, there appears to be a clear need to work towards the development of a common framing between actors.

4.1.4. Fragmented Financing: Insufficient and Variable Resources

Unstable or insufficient revenues can undermine effective implementation of policies at the sub-national level. This is particularly the case of transport and land-use where the level of funds required for investment tends to be significant, if not often prohibitive. As seen in Table 24, limitations in France are due to insufficiency of funds linked to the scope of the investment needed, the dependence on transfers and private sources of funding, as well as the consideration of both investment and operating costs. Variability is equally a limitation, as sources of financing are often linked to economic activity or are periodic in nature.

Table 24: Fragmented Funding

Insufficient	- Scope of investment needed - Dependency on transfers - Investment vs. Operating costs
Variable	- Based on economic activity - Periodic nature of subsidies and call for projects

The scope of funds needed to launch both large-scale transport as well as urban renewal and densification-redevelopment programs tend to be in the hundreds of millions of Euros. For example, recent investment in the Grenoble tramway network totaled over 300 million Euros (Gusmeroli 2010). While, as discussed above, local EPCI structures have access to the *versement transport* as an important local source of revenues, other authorities (*régions, départements*) do not have access to these funds. As such, these authorities may be dependent on transfers from the central government (either through calls for projects, and annual or one-time subsidies). Further, local authorities in both Grenoble and Nantes have experienced a limited involvement from the private sector, particularly in urban-redevelopment projects. Given the political difficulties often encountered in launching large-scale urban-redevelopment projects, the private sector tends to participate once the project is off the ground and significant initial investment has already occurred, such as in the case of the *Caserne de Bonne* urban redevelopment (Coindet 2010). Thus, due to limitations in terms of finance as well as technical capacity, mayors and most *communes* are often left dependent on private-sector initiatives, which tend to occur in green-field and or suburban areas due to lower costs and fewer stakeholders involved (EP SCOT 10.10.20).

Transportation projects are further complicated by the need for both initial construction-related investment costs and on-going operational expenses. Often nationally and/or locally established transport pricing may make operating subsidies necessary, which are not always readily available. In 2002, tariff revenues covered only about 25% of operating costs while the *versement transport* provides covered close to 40% of this budget (see Table 18). However, it is important to remember that the value of *versement transport* is variable, based on the annual economic activity (payroll). Further, the central State in France is responsible for setting maximum levels for the *versement transport* while local governments decide local application. Often set at the current maximum rate, local authorities are unable to leverage more funds. While national subsidies in the form of calls-for-projects are often used for infrastructure investment, funding is not always available and insufficiencies have been identified in terms of the volume of funds available in relation to scope of responsibilities transferred to local authorities (*Réseau Action Climat* 2007). Further, funding from the central government for local-transport projects is often limited. Between 2003 and 2008, the French State offered no project funding. While in 2008 the Grenelle legislation established an envelope of 2.5 billion Euros available for public-transport projects, these funds were rapidly exhausted and it is unclear if further calls for projects will occur.[60]

[60] While financial obstacles are important, it is nevertheless necessary to recognize that it is not feasible to think that increasing funding is the key to solving the problem. As noted above, Grenoble Alpes Metropole has invested over 300 million Euros in their tramway recently. However, this has lead to only a 1% modal shift and

4.2. Challenges to Expertise and Information

The complex institutional context equally presents a number of challenges in terms of the expertise and information necessary to first manage and fully coordinate transport and urbanism, and second to integrate the objectives of reducing greenhouse gas emissions into the process. Actor groups are constrained by limits in terms of the technical capacity to analyze and implement strategies (identification of appropriate actions, analysis of systemic impacts of individual policies), as well as to produce and integrate the expertise and information into decision making. Both of these gaps limit how accountability is used in accordance with the theories of collective action (explored in Chapter 1) to incentivize and facilitate collective action on GHG mitigation.

4.2.1. Capacity Limits: Technical Difficulties of Linking Transport and Urbanism

Insufficient scientific, technical, and implementation capacity on the part of local actors can limit their ability to treat transport and urbanism subjects. As shown in Table 25, a number of limitations in terms of analytical, implementation and workload capacity can be observed in the French context.

Table 25: Capacity Limits of Actors

Analytical Limits	- Evaluation of impacts of plans and projects - Interaction between transport and urbanism - Identifying systemic effects - Producing multi-criteria analysis
Implementation	- Translation of orientations into actions and policy prescriptions - Assuring coherence between planning documents (timing and transversal nature of actions)
Workload	- Evaluation of planning documents (*préfet*) - Availability of technical assistance

First, in terms of analytical limits, the lack of capacity of local authorities to develop and evaluate the impacts of plans and projects, whether in the transport or urbanism sector, can limit both the ability to develop planning documents, and select the appropriate policy action to achieve objectives. Planning documents and needed multi-criteria project evaluation (see Chapter 5) requires a wide range of social, economic and environmental data that are typically rarely available in their entirety at the scale of planning documents and/or costly to produce. As such, local authorities may not be able to produce or analyze the necessary information to understand the long-term transport and land-use trends, as well as the appropriate interventions to achieve objectives.

This is further exacerbated by the evaluation of the interactions between transport and urbanism in general. This capacity limit may stem from the inability to collect and treat the necessary data, as well as difficulty in evaluating impacts from a single transport or urban intervention upon the entire networks and system. Often this requires the development and use of extensive and complex modeling tools that are intensive in data needs. For example,

limited reductions in vehicle traffic (Gusmeroli). It appears equally important to act on both the demand for mobility and policies to foster behavioral change.

Grenoble Alpes Métropole has calibrated the Visem/Davisum model to simulate transportation flows. This model, however, is highly dependent on the results of the household mobility survey (*l'Enquête Ménages-Déplacements*) which is conducted at a relatively large cost (more than 2 million Euros) approximately every 10 years. Data issues are further exacerbated by collection areas corresponding to administrative rather than issue-based perimeters and, thus, not capturing the whole "picture" necessary for analysis.

Implementation

The technical capacities necessary for the translation of orientation and planning documents into practice actions, as well as implementing the identified actions and policies, can also be lacking. Often, moving from the macro-scale recommendations present in the SCOT and PLH documents into concrete actions in the PLU poses a significant problem for local authorities who lack the analytical capacity, as mentioned above and/or the necessary resources (human and capital). Further, this limitation can extend into the ability to review impacts of building permits, etc., on social, economic and environmental objectives and whether they are coherent with planning and orientation documents.

The evolving institutional context equally poses challenges as local authorities (particularly those charged with the development of PLUs) must take into consideration and rapidly adapt to the SCOT, PDU, and PLHs, as well as the other required documents, are updated. This can be particularly difficult as these changes rarely occur concurrently. Further, local institutions may have no direct homologues in adjacent territories and, thus, even when desired, cannot attempt to develop coherent transport and urbanism policies. For example, in the territory surrounding Nantes Métropole, there are in many areas no designated AOTs charged with the development of a transportation policy beyond the interurban bus and rail services of the *Département* and the *Région*. As such, without a clear homologue, the *DG Déplacements* in Nantes is often required to work directly with multiple individual *communes*.

Workload

Finally, the total workload placed on local authorities can limit their ability to manage transport and urbanism policies fully. For example, the regional and departmental *préfets* have an important role to play in terms of evaluating the coherence of transport and urban-planning documents. They are charged with assuring that the process followed is coherent with national legal objectives, respects requirements in terms of process, as coherence with existing planning documents, such as the SCOT (see above). However, limitations in terms of resources can reduce the level of detail of the analysis conducted. Equally, EPCIs and other agencies assisting individual *communes* in the development of their PLUs as well are faced with constraints. For example, at the EPSCOT[61] in Grenoble Alpes Métropole, only three out of the team of 10 staff are charged with assisting the EPCI and over 250 individual *communes* with the translation of the SCOT into PLUs and operational decisions. As such, those bodies, often charged with either ensuring the quality of the documents produced or assisting in the

[61] The EPSCOT (*Etablissement Publique du SCOT*) is the public agency created to develop and implement the SCOT.

process itself, do not have the resources to do so.

4.2.2. Information Gaps: Knowledge for Managing and for Delegation

Asymmetries of information between policy making and/or implementation authorities and between public and non-governmental actors can create significant hurdles from transport and urbanism policy making and coordination. As seen in Table 26, asymmetries of information can exist between policy making and implementing authorities, both across and within scales of governance, as well as between public agencies as well as private and/or public companies involved in development and service provision.

Table 26 : Information Gaps

Limitations	
Implementing Agencies	- Coordination across levels (*Région, département, commune*) - Delegation from EPCI to *syndicats mixte, établissements publiques*
Private and SEMS	- Transport operators - Developers

Information asymmetries can exist between policy and implementing agencies, limiting the ability of the policy-making entity to accurately gauge the situation and ensure that plans and orientations are appropriately translated into actions. These are multiplied as the number of actors with different rationalities, perimeter of action and data requirements increases. For example, as noted above, with the LAURE legislation in 1996, the central State in France established energy consumption and pollution reduction as key objectives of all urban-transport policy. However, it is up to local authorities to translate these orientations into policy actions. As no reporting mechanism has been established to allow the central State to track the progress of local authorities in achieving these orientations, assuring full compliance may be limited. More concretely, a similar issue has been noted due to information asymmetries between the SMTC and Grenoble Alpes Métropole concerning the development and implementation of transport policy. As the inter-communal structure has delegated the responsibility for transports (AOTU) to the SMTC (an independent *sydicat mixte*), this agency has a monopoly on both technical expertise and operational experience. As such, Grenoble Métropole has encountered difficulties in ensuring the needed oversight of the functioning of the SMTC (Uhry 10.10.21).

Information asymmetries are also present in the relationship between public entities and the companies with whom they contract. Actors at all scales may lack the expertise and information necessary to judge and negotiate with the private sector on project development (Tahamazian & Loustou 10.10.20). In terms of both urban development and the transport-services provision, difficulties have been encountered in the micro-scale implementation of policies and actions. For example, both Grenoble Alpes and Nantes Métroples have encountered difficulties in engaging private developers in the development of an urban-housing supply that is both dense, low-emission and attractive to the population (Denizot 10.10.21). Stemming from a noted hesitation in the private sector to invest in often-complicated redevelopment projects with potentially high levels of public opposition (NIMBY-ism), a lack of information in terms of the engagement of the public authority may exacerbate their hesitation. In the transport sector, public authorities are often highly dependent on operators, as service providers have more intimate knowledge of the network and its functioning. As such, local authorities may not be able to influence quality-of-service issues. The complexity of the delegation-of-service provision can limit accountability and the communication of information on performance.

4.2.3. Implications for Accountability: Ensuring Communication and Compliance

The complex institutional context for the governance of transport and urbanism suggests a difficulty to ensure accountability and transparency of practices across the different constituencies. This stems from a lack of indicators necessary for comparison or from the structure of the process itself, which may not produce evaluation information that can easily be incorporated into decision-making.

Table 27 : Limitations on Accountability

Indicators	- Lack of clear responsibility - Lack of indicators
Process	- Timing of evaluation (ex-ante vs. ex-post)

In general, assigning and tracking accountability in transport and urbanism projects remains underdeveloped in the French context (CERTU 2007; *Réseau Action Climat* 2007). This is particularly the case where there is little structured measurement of the impacts of urban planning and redevelopment projects. While a battery of indicators, including density, real-estate value, mixed-use, housing produced, jobs produced, etc., are often developed and tracked, few clear lines of responsibility for these numbers can be established. As such, accountability is diluted over the whole of the actors in the sector. While a number of indictors are used in the case of transport planning, often the principal evaluation measure is the economic efficiency of operating public transport (internal rate of return, socio-economic benefit per Euro invested, net present value), which does not potentially capture all social, economic and environmental benefits.

The current evaluation process for both transport and urbanism tends to be front-loaded, with the bulk of evaluation occurring ex-ante, before or during the development of new or revised documents. Given that evaluations are required every 5 to 10 years, this does not allow for a continual analysis and adjustment. Nevertheless, a number of AOTU have established "transport observatories" to monitor the implementation of the PDU and the development of transport projects (see Chapter 5). However, delays in information are not surprising, given an evaluation's dependency on a wide range of data that is not collected annually, and further complicated by the fact that impacts of planning and urban interventions tend to be seen in the middle- to long-run.

4.3. Summary and Implications of Institutional Context on GHG-Emissions Reduction: Constraints on Capacity to Coordinate Action

As described above in Table 13, there are a number of different types of actions that can be used to reduce greenhouse gas emissions stemming from the urban passenger transport sector. These actions are transversal in nature, touching both transportation policy as well as urban planning. Through coordinated policies influencing technology changes, reducing the number of trips, reducing the distance traveled, modifying the modal share and treating issues of urban and public-transport attractiveness, significant steps can be made towards reducing emissions.

Table 28 : Summary of Impacts of Gaps on the Ability of Local Authorities to Manage and Coordinate Transport and Urbanism

	Impact on Ability to Reduce Related GHG Emissions through Urbanism	**Impact on Ability to Reduce Related GHG Emissions through Transport**
Governing a Fragmented Context		
Administrative Fragmentation	- Ability to coordinate development, plan and limit growth across the entire urban area	- Ability to coordinate transport police at the scale of the commuting area - Limited ability to develop a multi-modal offer facilitating the use of modes of transport alternative to the personal automobile
	- Ability to coordinate transport- and urbanism-planning documents with different boundaries	
Fragmented Jurisdictions	- Ability to foster and promote densification, mixed-use urbanism, multi-polar urbanism, roadway sharing due to the fragmentation between and across levels	- Ability to provide a multi-modal offer due to the need for coordination between the different agencies involved, spread across multiple levels of government - Ability to incentivize behavioral change through targeted policies (i.e. parking policy)
	- Ability to overcome fragmentation of competencies to coordinate urbanism and transport	
Fragmented Objectives	- Ability to coordinate and produce a coherent transport and urbanism policy due to: - Discontinuities between objectives between and within urban-planning and transport documents and policies - Conflicts between systemic changes vs. project-based incremental modifications	
Fragmented Funding	- Ability to invest in projects promoting densification, mixed-use urbanism, multi-polar urbanism, roadway sharing	- Ability to invest in the expansions on the public transport infrastructure - Limitation on operation of network (frequency, routes, stops, capacity etc.) - Ability to invest in low-emission technologies
	- Ability to hire sufficient staff and procure the technical expertise necessary - Ability to launch projects to attract additional private- and public-financial flows	
Information and Expertise for Collective Action		
Capacity Limits	- Ability to analyze the impact of planning decisions on GHG emissions, either directly or through relationships and impacts on transport and mobility (demand for mobility, distances, facilitation of modal shifts) - Ability to develop targeted actions and policies from over-arching strategy and orientation documents - Ability to coordinate land-use planning and transport - Ability to understand the impact of choices concerning transport and urbanism on GHG emissions	
Information Limits	- Ability to engage and coordinate between the public and private sectors in different configurations to facilitate densification and mixed-use urbanism	– Ability to control the quality of service and operational speed (potential loss of modal share due to reduced attractiveness and quality of service) - Ability to incentivize and foster technology changes by operators (improve efficiency of vehicles and systems)
Accountability gap	- Ability to assign responsibility to individual actors and develop outcome-based measures to incentivize action and ensure accountability (from intentions to actions)	

However, as summarized in Table 28, the different “gaps” induced by the multi-level-governance institutional framework for transport and urbanism policy in France can reduce the ability of local authorities and other actors to put into place the policies necessary to reduce greenhouse gas emissions. Barriers stemming from administrative, policy, objective and information gaps limit the ability of actors to work together across often over-lapping and limited administrative boundaries to develop coordinated and coherent transport and urbanism strategies. Capacity limits reduce the ability of actors to produce the necessary expertise and apply this information when translating over-arching objectives and strategies into concrete policies and actions. Funding gaps limit the ability of public actors to launch investment in urban-development and transport-infrastructure projects that could potentially attract complementary private financial flows. Finally, accountability gaps limit the attribution of responsibility to specific actors and, thus, limit the necessary incentives for the good intentions to be translated into concrete actions.

5. FROM INSTITUTIONAL FRAGMENTATION TO POLYCENTRIC GOVERNANCE: COORDINATION, RESOURCES AND INSTITUTIONAL MODIFICATIONS

The institutional context in France creates a complicated and often fragmented policy environment for the development, coordination and implementation of transport and urban-planning policy. This context can hinder the achievement not only of greenhouse gas emission reductions in the urban passenger transport, but equally of other economic, social and environmental goals and objectives. As presented in Chapter 1, given the complexity and need for action at multiple levels of government characterized by the transport and urbanism sectors, it appears that promoting a polycentric system is appropriate. However, the success of a polycentric system will depend on the ability of its actors to coordinate and communicate, while at the same time overcoming the different limitations presented above. While the barriers are often daunting, touching on both systemic and contextual issues, actions have been taken over the past two decades to foster better integration of transport, land use and urban development.

Often independent of concerns for greenhouse gas emissions, a number of modifications of the transport and urban-planning sectors have occurred with the purpose of improving transport and land-use planning to halt urban sprawl, promote the use of public transport and reduce the role of the private vehicle in urban areas while simultaneously reducing local air pollution. Drawing on the two case studies of Nantes-Métropole and Grenoble Alpes Métropole, the following section presents a number of the actions taken to date, positioning them within a polycentric vision of governance, as well as identifying a number of further actions that appear necessary.

5.1. Coordination: Expanding Planning and Improving the Transport – Urbanism Connection

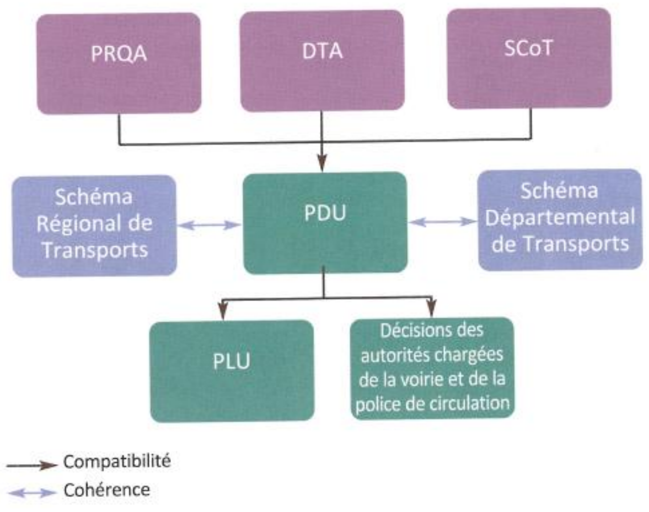
Improving the coordination between actors is an important step in overcoming governance fragmentation. Improved coordination appears necessary externally between different authorities and actor groups, but equally internally across the different services involved in developing and implementing transport and urban planning policy.

5.1.1. Improving the Transport – Urbanism Connection

The introduction of the different planning documents, steps towards their coordination, and the requirements for the integration of energy use and personal-vehicle reductions in urban areas have all made significant steps to improving the ability to achieve policy objectives. At the national level, evolutions in the legal framework since the mid-1990s have demonstrated a clear objective to coordinate transport and urbanism better as well as improve consideration given to economic, social and environmental impacts of projects. This has included the LAURE legislation in 1996, recognizing the need to address energy use and the role of the private vehicle in urban areas better; to the SRU legislation in 2000 requiring that the PLU must be in coherence with the PDU; and most recently in 2010, the Grenelle II has created a number of different modifications to the legal framework that has opened up new pathways as well as providing new tools to local authorities.[62]

The system of planning documents has attempted to integrate this need for sectoral coordination, particularly between transport and urbanism (SRU law 2000). Figure 15 demonstrates what this means in terms of the PDU, which must be *coherent* with a number of documents, including the *Schéma Régional* and *Départemental de Transports*. It must, however, *comply* (*compatibilité*) with the guidelines, norms and objectives laid out in the *Plan Régional de protection de l'atmosphere (PRQA), the Directives territoriales de l'aménagement (DTA)* and the *SCOT*. Further, a number of documents must comply with the PDU, including the PLU and the decisions made by the different authorities charged with transport infrastructures and the traffic police. While the mandate to coordinate the PDU with other documents exists, application in practice can still be difficult.

Figure 15: Links between PDU and Other Planning Documents



[62] This included the ability to experiment with urban congestion charging as well as different forms of local taxation to promote densification.

Source: GART 2010

The current priorities established by local authorities equally recognize the need to achieve better coordination. In Nantes Métropole, there is a recognition that what is needed to reduce both GHG emissions as well as achieve other transport and urban-development objectives is to take a more holistic approach that increases density and renders the urban environment more attractive simultaneously (Guillard 10.12.07). Further, based on past experience, there is recognition that the integration of public transport that functions properly into urban-planning documents can influence behavioral changes (Herbreteau, Ranty, & Garrigeu 10.12.07), thus leading to an expansion of the transport offer. Equally in the Grenoble Alpes Métropole area, a number of objectives based on both established national priorities as well as on local concerns that attempt to address the dynamic interactions between transport and urbanism better. *La Métro* has identified the rebalancing of employment and residence locations across the urban area as a key component in reducing the demand for mobility. Further, there has been a clear effort to continue the development of public and non-motorized transport modes directly translated into all planning documents.

This has led to the development of a number of transport projects to improve the functioning of public transportation as well link transport and urbanism. Both EPCIs are attempting to identify options to reduce the demand for mobility in suburban areas while, at the same time, improve the offer of public transport in these zones. Nantes is currently working with the *Pays de la Loire région* to expand the regional rail service and establish an *Etoile Ferrovaire* (radial rail network) to link these areas with the city center. At the same time, they are equally implementing the *chrono-bus* network in the suburbs, partially lane-segregated buses to link the peripheral *communes* into the larger transport network. This project has played an important role in getting mayors on board with a number of projects, as it is perceived by mayors to be a means of extending public transport to the front doors of their *communes* (Herbreteau, Ranty, & Garrigeu 10.12.07). Similarly, officials in Grenoble are currently developing an approach to reducing the demand for mobility generated in suburban areas through the *Chrono-aménagement* strategy. Part of the larger discussions surrounding the SCOT currently in development, the purpose of *Chrono-aménagement* is to reduce the demand for mobility through pairing urbanism that fosters the creation of services and employment around existing secondary urban poles while decreasing the speed limits along major linking axes as to make trips between areas more "costly" in terms of time spent. The objective is to incentivize individuals to do their activities closer to home through timesaving. While still in the planning stages and often suffering from a number of critics as well as questions concerning political feasibility (i.e. during non-rush hour traffic periods), it represents an important effort to use both transport and urbanism tools to influence development in the greater urban area and incentivize behavioral change.

5.1.2. Mechanisms and Tools in Practice: the Use of Contractual Mechanisms and Other Collaborative Tools

There equally appears to be a growing trend using contracts and formalized agreements to coordinate transport and urbanism, typically around specific transport projects. Increasingly, AOTUs are negotiating these *contrat d'axe* and similar agreements with the *communes* located along new or redeveloped public transport lines. To ensure the success of the larger project, the *communes* commit to redevelop actively the area surrounding the public transport line, including densification, the creation of areas for office and commercial space, and in general, mixed-use land use. These contracts allow for the formalization of expectations concerning the entire redevelopment accompanying the creation of the transport line, thus ensuring a coherent rehabilitation.

Grenoble Alpes Métropole has developed and implemented a number of mechanisms to facilitate the interactions between transport and urbanism. The *demarche urbanisme-transports* has applied the concept of *contrat d'axe* to its development projects, notably with the development of the Line E. As such, a concentrated effort is occurring to densify and develop both economic and other services along the proposed transport line. Second, to coordinate the different operators and actors involved in the provision of transport services better, the Métro has recently created the GMCD (*Gestion multimodale centralisée des déplacements*). The objective of the center, bringing all of the involved actors together into a single location, is to improve the daily management of the transport networks, including the provision of real-time information. In terms of urbanism, the EPCI has focused on means of facilitating the translation of the objectives and plans developed in the SCOT into the local-scale planning documents. As such, the EPCI develops a *shéma de secteur* at the scale of the 27 *communes* of the agglomeration (compared to the 250+ *communes* included in the planning perimeter of the SCOT). The EPCI has equally developed, however limited, shared technical capacity to assist the smaller *communes* within the agglomeration with the development of urbanism documents. Further, the Métro, like Nantes, has developed a set of guides for real-estate developers to align their projects with EPCI's objectives better.

Nevertheless, while numerous mechanisms are being developed to foster coordination, they tend to remain confined to the scope of the perimeter of the EPCI itself. It appears that further efforts are need to include suburban areas where most current growth is occurring within transport and urban planning better.

5.2. Finance and Expertise

Beyond fostering increased coordination, it appears that a number of the basic "resources" necessary to govern effectively transport and urban planning are lacking across levels of governance. Both information, necessary to support and assist in decision-making processes, as well as increased financial resources, appear key to fostering a polycentric governance model.

5.2.1. Informational Tools and Observatories

A number of initiatives have been developed to improve the access to and the use of information for the transport and urban planning decision-making process. Across France, legislation has increased requirements for public consultation within the development of transport and urbanism documents (see Chapter 5); it has also required a better tracking of transport finances through the *comptes transports* reported by both AOTs as well as delegated service providers. "Observatories" charged with the development, data collection and tracking of indicators on both transport and urbanism have been created to improve data collection and evaluation of impacts. Additionally, the range of actors involved in the development of transport and urbanism documents is expanding. While this has improved the availability of information, steps still need to be taken to make the evaluation process an important part of the decision-making process.

5.2.2. Experimenting with New Forms of Financing

Additional, stable forms of financing for both transport and urban development appear necessary. Given the potential variability of the *versement transport* due to economic conditions and the inability of urban authorities to increase rates beyond the nationally imposed ceiling, the large sums necessary for public-transport development remain beyond the reach of authorities. In terms of the transport sector, 2008 saw the creation of a one-time envelope of 2.5 billion Euros to finance (up to 20% of total investment costs) urban passenger-transport projects with the objective of building 1,500 km. Beyond this one-time subvention program, the *Grenelle II* legislation in 2010 allows local authorities to experiment with land-value capture tools (*Taxation des plus-values foncières*). This form of taxation will allow local authorities to "capture" the value-added of transport-infrastructure investments within a limit of 5% of the total value of the property.[63] It, however, remains uncertain as to what extent this will be adopted and provide a significant source of funding for local authorities.

As described above, financing barriers equally limit urban-planning objectives. The last decade has seen the development of a number of project and contractual-based tools to finance large-scale urban-development projects. These include EU financial and technical instruments, such as JESSICA and HELENA, and the *Contrat de Plan État-Région*. The French State through its public finance institution – the Caisse de Dépôts – is currently implementing an investment-tender program as part of the *Ville de Demain* program. This will provided funding for selected projects applying both larger sustainable development as well as GHG-mitigation criteria. In addition to these subsidy programs, recent legislation has equally given local actors a number of tools to raise their own finances. The urban development tax (*taxe d'aménagement*) has replaced a number of existing fiscal tools and is levied on real-estate-development projects by local authorities that have developed a PLU. The resulting funds are slated to be used in developing the needed infrastructure in achieving the development goals laid out in the SCOT and PLU and are affected to the competent jurisdictional authority. A second fiscal tool, a tax or charge on low-density development (*versement pour sous-densité*) allows local authorities to establish a threshold for minimum density in a zone and tax the development of real-estate projects that do not meet the established criteria. While progress has been made in creating the necessary transfers to local authorities as well as giving them the tools to raise further funding, the securing of more resources is still necessary.

[63] This tax applies to the first transfer of property after the start of the infrastructure project. The AOT defines the scope of application: it can not exceed 1,200 m "around a transit station created or served by the new transport infrastructure or railway station entrance." In the area between 800 and 1,200 m, the tax rate is halved. Finally, the total amount paid by the taxpayer may not exceed 5% of the real-estate sale price.

5.3. *Institutional Modifications: Balancing Transport and Urban-Planning Perimeters*

While less developed and limited in scope, authorities have begun to address the principal institutional limitation that renders the uptake of these subjects of planning and administrative perimeters difficult. Enabled by national legislation, efforts are underway to modify institutional boundaries, configurations and roles to foster coordinated policy making and implementation.

5.3.1. Inter-communal Structures Restructuring Their Planning Perimeters…

In the interest of improving cooperation in the organization transport beyond the confining distribution of competencies, the law SRU in 2000 created the possibility for the different AOTs in a given urban area to come together and create a *Sydicat mixte de transport* (*Syndicat Mixte SRU*). This structure allows multiple AOTUs to come together to expand the perimeter of the PDU planning area.[64] For example, Grenoble Alpes Métropole has made significant steps towards creating a *communauté de transports* with an expansion of the suburban area for the planning and administration of public transports beyond the limits of the EPCI (Gusmeroli 10.10.21). Nevertheless, a number of questions remain to be answered concerning instructional organization, governance and financing of such an institution.

Nationally there has been a movement (albeit slow) towards PLUs developed at the scale of the entire EPCI rather than developed by each *commune*. The Grenelle II legislation has reaffirmed this movement, noting that *communautés urbaines* and *d'agglomération* will now have this competence unless otherwise contested by the individual *communes*. Beyond treating institutional configurations only at the scale of the EPCI, it is expected that the 2014 national territorial reform will allow for the creation of *Pole Métropolitain* to group together the necessary actors at the scale of the entire urban area better. However, the operational details of a new layer of governance are still under development.

5.3.2. …but an "Ideal" Remains Uncertain

While coordination mechanisms and the individual projects and larger-scale objectives have occurred, a number of barriers to institutional modifications have been encountered. Both ideological and political in nature, these barriers have delayed any significant evolutions in terms of the transfer of power between types of authorities. The strongest limitations may stem from the political tension that can exist within inter-communal structures. Interviewees noted that in some cases individual *communes*, mayors and other authorities often "fear" being blotted out by the larger agglomeration itself, as well as the typically influential central *commune* around which the inter-communal structure has been built (Poimboeuf 10.10.21; Gusmeroli 10.10.21). Politically, due to the large number of *communes* of varying size, economic weight and political influence, there is a 'fear' of being dominated by the often

[64] However, the number of *Syndicat Mixtes* SRU created have remained small (totaling 7 in 2010). Furthermore, while these structures may improve the matching of PDUs and PTUs to the actual communting area and urban zone, they may lead to a further fracturing of coordination between different groups charged with urbanism and transport and multiple EPCIs that become involved in addition to the multiplicity of *communes* already implied when an AOTU is a CA or CU.

much more powerful and resource-rich central *commune* or *communes* in the inter-communal structure (10.10.22 Lebras). As such, efforts to centralize jurisdictional competencies at the level of the inter-communal structure have often been met with great opposition by those authorities and officials likely to lose their influence (Uhry 10.10.19). A more ideological argument against the centralization of competencies has also been noted; there seems to be a clear separation of approaches with, on one hand, a movement towards centralization and, on the other hand, the desire to foster cooperation rather than a fusion of the *communes* and a change in the balance of power.

The different possible institutional structures based on the information above are summarized in Table 29. Concerning the perimeter at which transport planning occurs, given the need to enhance coordination, it appears that the most appropriate level for jurisdictional control is that closest to encompassing the entire urban area. Second, concerning the coordination between urbanism and transport, it assumes a theoretical optimum when the same institutional structure is charged with both tasks to ensure better the link between land-use, jurisdiction over right-of-ways and construction permits are coordinated in a similar fashion, as well as circulation police and parking. However, the search for the "perfect perimeter" may be deceptive, as it is important to understand how perimeter and the distribution of competencies can serve as impediments to coordination and cooperation. A number of different configurations may be available that must be adapted for the given political and historical context within which transport and urbanism policy making occur.

Table 29 : Range of Possible Institutional Relationships between Transport and Urbanism Competencies

Competency					
Transport	*Commune*	EPCI	EPCI	EPCI SRU	EPCI SRU
Urbanism	*Commune*	*Commune*	EPCI	EPCI	*Commune*
Transport Perimeter	0	+	+	++	++
Rational	A PTU at the scale of the *communes* is, in most cases, too limited unless in small communities	PTU at the scale of the inter-communal structure is good; however, it may not cover the entire urban area (*basin de transports*)	PTU at the scale of the inter-communal structure is good; however, it may not cover the entire urban area (*basin de transports*)	PTU at the scale of multiple EPCI is better	PTU at the scale of multiple EPCI is better
Coordination w/ Urbanism	0	-	++	+	--
Rational	Urbanism and transport coordinated by the same entity; however, the entire urban area may not be taken into account	Competency for PDU and PLU conducted by separate entities	PDU and PLU conducted by same entities; land-use must follow PLU	PDU and PLU better coordinated; however, PLU and PTU do not have the same perimeter	Perimeter of PDU and PLU are greatly different
Totals	0	0	+++	+++	0

Source: Author

While a number of institutional modifications are possible and, in many instances, necessary, it is important to recognize their "cost", both politically as well as operationally. It is nevertheless important to note that, while efforts have been made to introduce legal modifications, different mechanisms and institutional changes to fill the "gaps" in transport and urban policymaking, a number of obstacles remain. Modifying institutional boundaries and the distribution of competencies can be seen by actors as rationally logical, but politically detrimental. Further, much of the literature notes that a radical modification of institutional arrangements, many of which are enshrined within the French Constitution, is highly unlikely even in the medium-term (CERTU 2007).

As such, the polycentric organization of urban and transport planning advocates the centralization of the oversight of the development of both transport and urban planning documents. However, this must be balanced with a continued participation of both *communes* as well as the local population, not only to bring the necessary local contextual knowledge, but also equally to legitimize the resulting process.

6. CONCLUSIONS: TOWARDS THE POLYCENTRIC GOVERNANCE OF TRANSPORT AND URBAN PLANNING

While part of the larger puzzle, reducing GHG emissions from the urban passenger transport sector is not just about fostering technology change. As seen in the literature, there appears to be a consensus that addressing GHG emissions from the transport sector requires going beyond technological improvements that, while important, do not treat the continued increase in the number of daily trips and distance traveled. Research has clearly linked automobile use, urban sprawl, density, energy consumption and GHG emissions, indicating that energy consumption and density in urban areas are negatively correlated. Further, rather than just focusing on density, it is important to take into consideration the entire urban structure (i.e. the location and distance between housing, services, places of employment, etc.). Combined, existing work suggests that the demand for mobility and transport services are an induced demand stemming from the larger urban context. As such, it is important to take into account the interactions between transport and urbanism as reducing both distance and emission intensity, which is linked not only to fostering dense development, but also to fostering mixed-use as well as the infrastructure necessary to foster modal changes. Often, it appears that GHG reduction is not about doing something new, but rather about continuing existing efforts to achieve other social, economic and environmental objectives in a more-comprehensive fashion. Systemic changes are necessary to influence and reduce the number of trips, distance traveled, and emission intensity of each trip.

The last few decades in France have been marked by a continued increase in development in suburban (*peri-urban*) areas, typically within the greater metropolitan areas, but beyond the direct administrative control of the *communautés urbaines* and the *communautés d'agglomeration*. As such, it seems clear that the institutional context within which urban passenger-transport policy is formulated and implemented is equally important. This chapter has explored the questions of how the multi-level governance arrangements of transport and urbanism in France affect the ability of policy makers to reduce GHG emissions in the urban passenger-transport sector. The legal and institutional context described above creates a complex environment within which land-use, urbanism, and urban passenger-transport planning occurs in France. While the decentralization of authority from a historically State-centered model to the appropriate sub-national institutional actors should be seen as progress towards a more-contextualized governance, the resulting fragmentation due to the large number of local-scale actors has created a complex governance context.

As summarized in Table 28, the different limitations induced by the multi-level institutional framework for transport and urbanism policy in France can reduce the ability of local authorities and other actors to put the policies necessary to reduce greenhouse gas emissions into place. As hypothesized, the ability of local authorities to foster the collective action necessary to reduce GHG emissions from the urban passenger-transport sector is characterized by the fragmentation of administrative boundaries, policy competencies, objectives and funding. These limit the ability of actors to work together across often over-lapping and limited administrative boundaries to develop coordinated, coherent transport and urbanism strategies. While inter-communal structures have access to the *versement transport*, thus giving them a substantial measure of autonomy in terms of transport, other funding gaps limit the ability to launch investment in urban-development and transport-infrastructure projects that could potentially attract complementary private-financial flows. Further, the institutional context has produced a number of limitations on the ability to produce the expertise and information for collective action on GHG mitigation. Capacity gaps limit the ability of actors to produce the necessary expertise and apply this information when translating over-arching objectives and strategies into concrete policies and actions. Finally, accountability gaps limit the attribution of responsibility to specific actors and, thus, limit the necessary incentives for good intentions to be translated into concrete actions.

Improving the governance of transport and urbanism requires moving from an institutional context within which a fragmented group of actors continues to make uncoordinated efforts separated by levels of government, sectors and actor groups. Steps have been taken in France to facilitate the governance of transport. Changes in terms of the legislative framework (devolution of competencies, etc.), different mechanisms, such as the increased use of contracting, guides and consultation processes as well as proposed institutional changes (creating of new institutions, modification of boundaries and competencies), appear to be steps in the right direction. Nevertheless, barriers remain, including the continued fragmentation in the distribution of competencies, the large number of planning documents, conflicting objectives and continuing difficulties to foster the needed coordination both within and between levels of government. As seen in Table 30, a number of further modifications are necessary to create an institutional context to foster the collective action necessary to reduce greenhouse gas emissions.

Given the need for coordination and further uptake of greenhouse gas mitigation into different policy areas, it appears that further reflection is necessary on how greenhouse gas mitigation is and can specifically be “mainstreamed” into policymaking. The following chapters analyze how climate policy is integrated across levels of government, focusing on the role of climate action plans (PCET) in France as well as how greenhouse gas mitigation has been integrated into the larger local-scale transport decision-making process surrounding planning documents and projects.

Table 30 : Recommended Strategic Orientations, General Policy Strategies and Needed Modifications for Polycentric Governance of Transport and Urbanism Policy

<table>
<tr><th></th><th>Strategic Orientations</th><th>General Policy Strategies</th><th>Specific Modifications Needed in France</th></tr>
<tr><td>French Central State</td><td>Foster polycentric governance at sub-national scale
- Avoid further fragmentation of capacities across levels
- Limit overlapping jurisdictions, but allow increased flexibility for cooperation and coordination of policy</td><td>- Rationalization of system: Require that perimeters of planning jurisdictions (SCOT, PTU) correspond to operational realities, not political division (to be overseen by préfets)
- Facilitate cooperation of local governments at the scale of the SCOT
- Facilitate development of SM SRUs for the PTU / PDU- important to overcome implicit financial obstacles
- Provide financial incentives to realign jurisdictions and competencies</td><td>Transport
- Assign transport competencies at the scale of the inter-communal structure
- Ensure coherence of transport planning perimeter (PTU) with the actual commuting area
- Depenalize and decentralize management and of parking violations to urban authortiies
Urbanism
- Urban planning (PLU) at the level of the intercommunal structure
- Establish an enforcement and implementation body for SCOTs under the joint oversight of the concerned urban authorities and functioning at the scale of the entire urban area
- Avoid further fragmentation with reform of local governments and the new “metropolitan” zones</td></tr>
<tr><td>Inter-communal Structure</td><td>Assure the coherence between transport, urbanism and climate-policy actions
- Establish coherent objectives
- Coordinate transport and urbanism within jurisdiction as well as with surrounding areas
- Implementation of SCOT at appropriate scale</td><td>- Coordination of planning documents through use of referents from each area
- Analyze impacts of both transport and urbanism action
- Coordinate PDUs between surrounding urban areas
- Ensure resources and political power to agency implementing region-wide development strategies (SCOT)
- Urban planning (PLU) at the scale of the entire urban area
- Coordination of actors involved with the operation of the different transport networks to ensure interoperability (ex. Grenoble Alpes Métropole multi-modal center)</td><td>Transport
- Expansion of transport planning perimeter (PTU) to the optimal balance of coverage of commuting area and increased revenues from the versement transports
- Transfer of transport-infrastructure competencies to inter-communal structure (voirie)
Urbanism
- Define areas for infill development in SCOT and PLU documents
- Transfer of oversight of urban-planning competencies (PLU) to the inter-communal level but also ensure continued involvement of the general population and individual communes ((legitimacy and local knowledge)
Coordination
- Develop mechanisms to link transport and urbanism projects (i.e. contrats d’axe)
- Engagement with the private sector through contractual and outreach mechanisms to link transport and urbanism (“conferences permanentes de coordination”)</td></tr>
</table>

CHAPTER 4:
COORDINATING GHG MITIGATION:
CLIMATE ACTION PLANS AND GHG INVENTORIES

1. INTRODUCTION

As a policy and governance challenge, the reduction of greenhouse gas (GHG) emissions to avoid further modification of the mean average temperature and the global climate presents a significant coordination problem. Achieving the collective action necessary to reduce the greenhouse gas emissions stemming from the daily activities of billions of individuals, private companies, and public entities requires both the coordination of actions between public and the private actors across multiple levels of government and activity as well as across economic and policy sectors given the transversal nature of reducing emissions. In the last decade, climate action plans (*plan climat energie territorial* or PCET in France), have been one of the principal tools developed to coordinate action on climate change. Paired with a battery of greenhouse gas emissions quantification methodologies and tools, initial steps have been made in facilitating the collective action necessary at the local scale to reduce emissions.

In Chapter 2, the need for local–level action was explored, indicating that the micro-scale intervention of local officials to facilitate greenhouse gas mitigation is a necessary complement to national-scale policies designed to influence the larger national economy and regulatory frameworks. Further, as seen in Chapter 3, the multi–level governance context within which transport and urbanism planning occurs in France creates a number of barriers to achieve the coordination necessary for emission reductions in terms of both the supply of transport services as well as the larger demand for mobility. This chapter takes a step further and analyses the plans and information tools currently in use to coordinate climate action, focusing specifically on the impacts on urban passenger transport in France. Drawing from the case studies of Grenoble-Alpes and Nantes Métropoles, the following sections identify the barriers to the collective action and the institutional and behavioral change necessary to reduce greenhouse gas emissions.

Recognizing that the local-scale GHG mitigation policy occurs within a multi–level governance context, this chapter first presents and analyses the institutional context within which climate change and greenhouse gas mitigation policy is implemented in France. Second, the impacts of a fragmented governance context as well as limitations on resources are explored. Finally, the chapter analyses the climate action plans and other climate-related coordination mechanisms that are beginning to be used to facilitate the transversal coordination and integration of greenhouse gas mitigation into different policy streams. Using Dietz et al.’s (2008) framework on environmental governance, the following sections identify the operational roles of these tools as well as better their impacts on efforts to reduce greenhouse gas emissions in the transport sector. It is hypothesized that institutional arrangements are key in achieving collective action around a policy subject, including the creation of flexible institutional arrangements to assist in conflict resolution and compliance as well as the development and provision of information and expertise on GHG emissions. These different processes appear key to achieving the polycentric governance necessary to reduce greenhouse gas emissions across and within multiples scales of action and policy sectors.

2. INSTITUTIONAL CONTEXT FOR CLIMATE AND ENERGY POLICY IN FRANCE

Charting the development and evolution of climate policy in France requires not only an analysis of climate-specific legislation and regulation, but also an analysis of the energy-related policy in place since the 1970s. Further, given the increasingly important role played by the European Union in coordinating and mandating action by member states on the subjects of climate energy, it is necessary to trace the development of related EU policy. This section briefly presents the international and national climate objectives, the system of strategic-planning documents being developed and briefly the technical actors assisting with climate policy at the national and local levels.

2.1. Ambitious Targets Based on Past Commitments to Energy Efficiency

While French legislation on greenhouse gas-emission reductions has set a number of ambitious objectives, the principal tool for fostering GHG mitigation has been the EU Emission Trading Scheme (ETS).[65] While broad in scope, the EU ETS does not include diffuse, non-industrial emissions, such as most transport, building and agriculture-related sources. While early national climate action plans identified strategies for reducing emissions across all sectors, they have often lacked the concrete policies need to achieve them. However, the adoption of the *Facteur 4* emission-reduction objective and the broad-reaching *Grenelle I and II* legislation (2009 and 2010, respectively) mark a new stage of climate policy. As such, ambitious emission-reduction targets for 2050 and a set of strategic documents are being put into place.

2.1.1. Translation of International Objectives into National Mandates

While energy efficiency and the rational use of energy have been treated in legislation since the 1970s, the issue of climate change and greenhouse gas emissions has only been addressed relatively recently. The first true phase of action on climate change began in 1997 after the signing of the Kyoto Protocol (entering into effect in 2005) that called for legally binding greenhouse gas-emission targets for developed countries. The aim of the protocol was a global 5.2% reduction from 1990 emission levels by 2010 (with a reduction of the EU-wide emissions by 8% between 2008 and 2012). The translation of these international

[65] The principal policy mechanism created by the European Union to aid in achieving its objective under the Kyoto Protocol is a market-based *Emissions Trading System (EU ETS*). This system allows the coverage of approximately 50 percent of European CO_2 emissions and 40 percent of all European GHG emissions (Ellerman et al. 2010). The cap-and-trade system was created by a directive in 2003, initiated in 2005 and entered into its third period in 2012.

commitments into EU-wide and French national objectives are summarized in Table 31.

Table 31: International and National Greenhouse gas-Emission Targets

	Mitigation Objective	**Reduction Horizon**	**Reference Year**	
International Commitments	Stabilization	2012	1990	Kyoto Protocol 1997
European Commitments	-8%	2012	2008	Kyoto Protocol / EU Burden Sharing
	-20%	2020	1990	Climate-Energy Package 2009
National Commitments	-75% (*Facteur* 4) or -3%/year	2050	1990	*Loi de programme fixant les orientations de la politique energétique* (2005) / Grenelle 2009
	-20%	2020	1990	*Grenelle* I & II 2009/2010

Source: After CERTU 2011.

International Engagements…

Translating internationally established emission reductions, the European Union integrated greenhouse gas-emission reductions into the 6th Environmental Action Program (2001-2012). Covering a broad range of environmental areas, this policy program calls for a reduction of GHG emissions by 20-40% by 2020. Through a process of burden sharing, the joint European Union emission-reduction objective was divided among member countries. Under burden sharing of the EU's Kyoto Protocol target, France is subject to a 0.0% reduction of emissions, meaning a curtailing of future emission growth.[66] This meant stabilizing GHG emissions at 144 million tons CO_2e in 2010 in spite of a projected economic growth rate of 2.2 % between 2000-2010. EU climate objectives were further reinforced in 2009 with the approval of the Climate and Energy Package. Known as the 20-20-20 targets, the legislation aims, by 2020, to reduce EU greenhouse gas emissions to at least 20% below 1990 levels; achieve 20% of EU energy consumption to come from renewable resources; promote a 20% reduction in primary energy use compared with projected levels, to be achieved through energy efficiency[67]. For France, this implies a reduction of 14% of emissions in 2020 compared to 2005 for the non-ETS sectors as well as increasing the share of energy from renewable sources in gross final consumption of energy to 23% in 2020 compared to 10.3% in 2005.

…Enshrined in National Policy

The translation of international and EU climate treaties and directives into French national legislation began principally in 2000 with the publication of the *Programme National de Lutte contre le Changement Climatique* (PNLCC). Since the publication of the PNLCC in 2001, almost annual legislation has shaped the framework within which climate change is treated and thus creates an increasingly strong mandate for action. First, the *Stratégie*

[66] France's low emission-reduction objective stems principally from its use of nuclear energy, given that the country has one of the lowest emission intensities in the electricity-generation sector and, thus, requires less effort in the short run from other sectors to meet national objectives.

[67] Composed of a number of directives, the approved package addresses four principal areas including: a strengthening of the EU ETS system; a revised effort-sharing decision for sectors not covered by the EU ETS, such as transport, housing, agriculture and waste;[67] binding national targets for renewable energy to 20% by 2020; and finally a legal framework for the deployment of carbon capture and storage technology.

Nationale de Développement Durable (*Agenda 21*) specifically made climate change a principal point of the overarching energy policy and linked it with the larger sustainable-development (SD) agenda. Second, the addition of the *Charte de l'environnement* in 2004 to the French Constitution made the access to a balanced, healthy environment a fundamental right enshrined constitutionally. Third, in response to a limited implementation of the PNLCC (in 2003 only 10% of actions had been implemented), the French State issued the national *Plan Climat 2004-2012* outlining specific actions to achieve French emission-reduction commitments.[68] Finally, in 2005 the *Facteur 4* emission-reduction targets for 2050 were adopted as a guiding principal for greenhouse gas emissions. Going beyond its Kyoto commitments, the *Facteur 4* objective aims to divide national GHG emissions in France by four in order to achieve the global objective of cutting global emissions in half by 2050. This long-term objective appears to have increased the mandate at all levels of government to reduce greenhouse gas emissions significantly, going far beyond both the current Kyoto and EU emissions-reduction objectives.

The most recent piece of climate legislation results from the *Grenelle de l'environnement* process launched in 2007 and has spread a wide-reaching mandate for engaging climate change. The *Grenelle I* was a wide-reaching consultation process designed to structure action for achieving environmental and climate objectives by bringing together national and local government officials, economic actors, and civil-society representatives. While proposing numerous objectives and strategies, *Grenelle I* identified few precise actions for achieving these goals, particularly in terms of their financing. The 2010 *Grenelle II* legislation was designed to implement the objectives identified during the *Grenelle I*. The *Grenelle II* calls for the modification a number of different legal codes[69] as well as the creation of new regulations, in order to translate the objectives of *Grenelle I* to all levels of government. A relatively complex law, *Grenelle II* will require over 201 *décrets d'application* or decrees.

2.1.2. An Emerging System of Strategic "Planning" Documents

Rather than being tied to the attribution of a set of actions or jurisdictions over a subject, reducing greenhouse gas emissions is linked to many jurisdictional competencies spread across multiple levels of governance. As such, different levels of government have been named competent for climate-specific strategic-planning documents typically linked to their jurisdictional competencies (see Chapter 3 and Annexes 3 and 4 for a full presentation of the distribution of competencies among levels of government in France). However, to date little to no formal hierarchy has been established among the different climate-related planning documents.[70] Rather, the scope of each document is limited to the jurisdictional competencies of a given authority.

[68] This document was further updated in 2006 with the *Plan Climat* 2006-2008.

[69] *Code de l'urbanisme, Code de l'environnement, Code rural, Code de la construction et de l'habitation, Code général des collectivités territoriales, Code des ports maritimes*, etc.

[70] While individual *collectivités* are required to submit the draft PCET to the *préfèt* and president of the regional council, it is only for consultation rather than any form of legal control.

Plan Climat National

The first *Plan Climat National* was established in 2004, building upon the objectives laid out by the *Programme National de Lutte contre le Changement Climatique*. Since then, it has been updated multiple times, most recently in 2010 after *Grenelle II*. Rather than identifying the actions to be taken by the State to reduce its operational emissions, it focuses on the national-scale incentives (loans, tax credits) and regulations (fuels, building) that the State can put into place to influence individuals and private companies as well as foster actions by local authorities. With the creation of the climate action plan and the establishment of a priority at the national level, an informal mandate has been communicated to other levels of government to address the climate and energy issues. Nevertheless, the national greenhouse gas-mitigation objectives have not been disaggregated with quantified emission targets (or incentives) assigned to sub-national actors. As such, it is often up to each actor to develop its own emissions-reduction target.

Schéma régional du climat, de l'air et de l'énergie (SRCAE)

Created by the *Grenelle II* legislation in 2010, the *Schéma régional du climat, de l'air et de l'énergie* (SRCAE) is a required planning document deployed at the level of the 22 régions in France. Elaborated under the joint control of the regional *préfet* and the president of the regional council, it is designed to integrate the existing planning and strategy documents addressing energy and climate within an overarching framework. It aims to define the objectives and regional guidelines at the horizon of 2020 and 2050 to limit air pollution, control energy demand, develop renewable energy, reduce GHG emissions and adapt to climate change. Further, the included guidelines serve as a strategic framework for local authorities to facilitate and strengthen regional coherence of actions and are designed to elaborate consultation with stakeholders to define quantitative and qualitative targets across each region. At lower levels of government, the *plan de déplacement urbain*s (PDU) must be compatible with the *SRCAE* while other urban-planning documents (PLU, SCOT) must take it into consideration. It does not, however, impose directly upon the *climat* action plans (*plan climat energie territorial* or PCET in French) developed by other sub-national authorities (*communes*, inter-communal structures, *départements*, etc.).

Plan Climat Energie Territorial (PCET)

Often stemming from pre-existing *Agenda 21* programs, a climate action plan, or PCET in French, is more than just a planning document. Rather, it is designed as a "territorial project" or framework within which to build a partnership among different actors in order to achieve greenhouse gas-emission reductions (ADEME 2009). The first generation of "*Plan Climat*" was developed voluntarily by different local actors to address greenhouse gas emissions without any formal obligation. Since the Grenelle I and II legislation, climate action plans or the newly christened *Plan Climat Energie Territorial* have become an obligatory planning and strategy document to be elaborated by both public and private actors to address internal operational emissions directly stemming from jurisdictional competencies. As such, all public entities with over 250 employees and all private companies with over 500 employees are legally required to elaborate greenhouse gas inventories and a plan of actions for GHG mitigation. Further, all entities with jurisdiction of a population over 50,000 must establish internal climate action plans to reduce operational greenhouse gas emissions. The scope of the statutory PCET only includes actions to reduce greenhouse gas emissions stemming from the operational activities (corporate emissions) of local governments. Nevertheless, many actors have equally chosen to take a territorial approach and include GHG emissions from all sources within their administrative jurisdiction.

Table 32: Climate Action Plans (PCET) in France by type of Local Authority (July 2011)

	Total	Implemented	
Région	13	8	62%
Département	22	8	36%
Communautés urbaines	9	2	22%
Communautés d'agglomération	54	10	19%
Communautés de communes	12	1	8%
Commune	31	6	19%
SCOT	7	0	0%
Pays*	42	9	21%
PNR**	19	7	37%
Other***	9	0	0%
Totals	217	51	24%

*Project-based planning area often uniting urban and rural zones.
****Parc National Regional**
*** The other category includes other forms of inter-communal cooperation, such as *Syndicat Mixtes*

Source: ADEME 2012

In March 2012, 217 PCETs were reported by the ADEME's *Observatoire des Plans Climat-Energie Territoriaux*.[71] As seen in Table 32, a wide range of actors have developed PCETs, including *regions*, *départements*, inter-communal structures, *communes* as well as other local authorities, such as the public bodies charged with developing SCOTs, *Pays* and national parks. However, of these, only 51 had been put into place. Further, of the 217, 35 result from voluntary action as they are under the legal definition as established in *Grenelle II* (greater than 50,000 inhabitants).

2.2. Additional Actors in French Climate Policy

In addition to the State as a policy maker and the different forms of *collectivités territoriales* in France, a number of other actors are directly implicated in climate and energy policy in France. The most important are listed below. At the national level, the principal actors are the *Direction générale de l'énergie et du climat* (DGEC) and the *Agence de l'Environnement et de la Maîtrise de l'Energie* (ADEME). The DGEC defines and implements the French policy on energy, raw materials, and the fight against climate change and air pollution. The ADEME is a national public agency under the joint authority of multiple ministries with the mission of encouraging, supervising, coordinating, facilitating and undertaking operations to protect the environment and manage energy.

[71] http://observatoire.pcet-ademe.fr/

At the local level, two of the most important actors tend to be the *Agencies Locales de l'Energie* (ALE) and the *Associations agréées de surveillance de la qualité de l'air* (ASSQA). The ALEs have become important actors in the areas of communication and public interface to develop local energy policies. The AASQAs are often active in the collection of data on atmospheric pollution[72] stemming from transport and other sources and serve as an important source of data as well as technical expertise for local actors. They work closely with their national homologue, the CITEPA[73], charged with monitoring national air-pollution trends as well as the development of the national greenhouse gas inventory.

2.3. Ambitious Goals, Multiple Cross-Level Actors and Disconnected Strategic – Planning Documents: A Need for Cooperation

As seen in the above section, the evolution of modern climate and energy policy in the 1970s in France has been shaped by EU regulations and national actions but equally by the evolving distribution of competencies across levels of governance in France. The translation of emission-reduction and energy-use objectives by the French Government and the development in 2000 and 2004 of structured national plans and programs to address greenhouse gas emissions has demonstrated recognition of this issue. Further, reinforced in 2005 by the adoption of the *Facteur 4* 2050 GHG-emission-reduction objectives, GHG mitigation appears to have become a long-term policy priority at the national level. Nevertheless, it is important to note that few concrete actions or the necessary resources have been identified to achieve ambitious reduction targets.

Greenhouse gas mitigation has been grafted onto existing institutions with each type of actor responsible for reducing emissions linked to its direct operational competencies. Given the distribution of competencies necessary to influence emissions among actors across levels of government, a number of planning documents (national - *Plan Climat National*, regional - *Schéma régional du climat, de l'air et de l'énergie (SRCAE)*, and local - *Plan Climat Energie Territorial*) have been developed to coordinate transversal action. To assist in this process, a number of specialized technical actors are involved in the climate-governance process assisting decision-makers at all levels with the development and implementation of policies. As such, the institutional context for reducing greenhouse gas mitigation remains complex and highly dependent on existing institutional forms and, as explored below, the barriers that both fragmentation and limited resources can present.

3. FRAGMENTED INSTITUTIONAL ARRANGEMENTS, LIMITED RESOURCES AND BARRIERS TO GHG MITIGATION

Over the past decade, a number of researchers have begun to study local climate-change actions. Often focusing on the motivations of local authorities to act and the identification of the barriers to good practice, this literature looks at both the political

[72] The ASSQAs are non-profit organizations with the mission of monitoring and collecting data information on local air quality; the dissemination of results and forecasts, as well as the immediate reporting of information on violations of air pollution thresholds and recommendations to *préfets*.

[73] *Centre Interprofessionnel Technique d'Etudes de la Pollution Atmosphérique*

economy of action as well as the institutional limitations often blocking progress. Many authors have framed the local–level governance of climate change as a multi–level governance issue demanding transversal action and coordination both across and among levels (Adger et al.; 2009; Bulkeley et al., 2009; Betsill & Bulkeley 2007; Moser, 2009; Corfee-Morlot et al. 2010; Corfee-Morlot et al. 2009; Kamal-Chaoui 2009). The jurisdictional capacity of local authorities depends on the devolution of the necessary policy competencies that allow for the development and implementation of mitigation policies. Success, thus, appears to require coherence across national-, regional- and local-policy incentives to ensure that mandates at different levels do not create disincentives for climate action at the local level (DeAngelo and Harvey 1998; Urwin & Jordan 2008; Adger et al. 2009). Second, given the nature of the policy problem and the need to coordinate the broad range of public and private actors involved in modern governance, the local authority's capacity to do so is crucial. Due to the cross-cutting nature of the challenge, coordination is not only necessary among different traditional sector-based divisions in government, but also among the private citizens, companies, NGOs and expert groups that influence decision making (Moser, 2009).

Further, a number of obstacles can arise related to the economics of local climate-change action, including the distribution of the costs and benefits, the problem of long-time scales, and mandate. The actual or perceived distribution of gains and losses can affect trust, cooperation and slow action. While direct co-benefits of mitigation policies may be perceived at the local level, the willingness to accept costs and changes in behavior can limit action. As discussed in Chapter 1, this can be linked to the problem of long time scales required to accrue the benefits of protective action to limit local climate impacts. Policy benefits tend to accrue over the middle- to long-run with little visibility in the near term; yet this is the period that matters politically to appointed and elected local officials. The ability of local decision-makers may be limited to go against political and economic pressure to alter development patterns away from business-as-usual pathways, given the short-term political cycle and long-term benefits. As such, how greenhouse gas mitigation is framed in relation to existing actions and linked to connected objectives by different actor groups appears important for fostering action. (Corfee-Morlot et al. 2010)

As seen in Chapter 3, the literature treats a number of institutional obstacles that can be related to the local authority's capacity to meet the policy challenges, including jurisdictional capacity, the capacity to coordinate action, and financial capacity (Charbit & Michalun 2009 and Charbit 2011). The legal and institutional context described in the above section creates a complex environment within which climate policy is developed and implemented in France. This section analyzes how the fragmented French institutional context, as well as limited capacity and resources, influences the sub-national governance of greenhouse gas mitigation, drawing on specific case studies conducted in Nantes Métropole and Grenoble Alpes Métropole.

3.1. Fragmentation of Decision-Making and Competencies

Similar to what was seen in Chapter 3, a fragmented institutional context influences the capacity of local authorities to achieve the levels of coordination to reduce greenhouse gas emission. Fragmentation can stem from the administrative perimeters of different authorities, the distribution of jurisdictional authority among actors as well as heterogeneous objectives and priorities. It is important to remember that, given the transversal nature of greenhouse gas mitigation policy and a need to touch on a large number of sectors simultaneously, climate policy is subjected to fragmentation related to its own institutional context as well as that of the sectors that must act.

3.1.1. Fragmentation Due to Administrative Perimeters and Distribution of Jurisdictional Competencies

Determining the most appropriate perimeter for action on climate change and the reduction of greenhouse gas emissions can pose a difficult challenge. As the impacts of local GHG emissions are global, attempting to circumscribe smaller perimeters to manage emissions is challenging. Fragmentation of action can stem from the scope of administrative boundaries and/or within the jurisdictional competencies held by each authority. The mismatch between the jurisdictional perimeter of authority managing a policy subject and the frequent boundaries of the subject itself (commuting area, catchment basin, etc.) can limit ability to influence the source of GHG emissions fully. While managing the reduction of internal "corporate[74]" emissions typically occurs within the administrative perimeter of the entity itself, when a local authority decides to address territorial emissions equally, the issue of administrative boundaries becomes important. This has been extensively described in Chapter 3 where authorities have difficulties in directly influencing the continued urban development beyond their jurisdiction, and thus, the resulting increases in transport-related emissions. The perimeter for the management of greenhouse gas emissions at the local level is dependent on the sectors targeted for reduction. As such, attempting to define the most appropriate boundary for action depends on the ability to federate the highest number of actors to achieve the critical mass necessary to incite policies that will incite GHG reductions. In France, the inter-communal structure is currently seen as the most appropriate perimeter at which to organize greenhouse gas-emission policies. In the cases of Nantes Métropole and Grenoble-Alpes Métropole, the *Etablissement Public de Coopération Intercommunale* (EPCI – see Chapter 2) is charged with managing the larger climate action plan.

Authorities attempting to implement greenhouse gas and emissions policies are also faced with the fragmentation of jurisdictional competencies. The responsibility for different sectors and sources of GHG emissions is often shared across and within multiple levels of government. Furthermore, within an individual entity, overlap of direct and indirect responsibility occurs among departments, services and individual actors. Internal fragmentation can influence not only the ability to implement internal-mitigation policy, but equally in terms of territorial actions. When reducing internal, corporate emissions, coordinating action requires the action across a number of departments and services. Either a single department is able to implement the emission-reduction policy internally, such as the choice to retrofit in the case of a *commune* of all the primary schools, or coordination is

[74] Greenhouse gas emissions that stem from operational or "corporate" activities of the local authority (heating, electricity use, vehicle fleet etc.).

required between two or more services within the same institution to achieve greenhouse gas emissions (i.e. urban transport). However, to influence territorial emissions, as discussed in Chapter 3, the requirement that transport and urbanism services work together to create the urban-development conditions in terms of both transport infrastructure and urban expansion and/or densification can be a barrier to achieving GHG mitigation. As different services and sectors often function independently, different means must be found to prioritize the integration of GHG mitigation into separate decision-making processes.

3.1.2. Overcoming Fragmentation through Coordination of External and Internal Action

Given both administrative and jurisdictional fragmentation, coordination of GHG mitigation action is key. Coordination must occur not only internally, across departments and services, but also externally with authorities and private actors as well as different levels of government (*régions, départements*, EPCI). Internally, achieving coherent action on GHG mitigation (as well as other policy subjects) is important to ensure that fragmentations and distribution of internal competencies are overcome.

Authorities, particularly at the level of inter-communal structure in France (*communauté urbaine, communauté d'agglomération, etc.*) will also need to foster external coordination with other authorities as well as private actors. First, the perimeter of the EPCI does not always completely cover the perimeter of the climate-related sector – such as the mismatch between the size of the larger commuting area and the perimeter of the PDU[75]. Further, as greenhouse gas-emission reduction is about reducing emissions from often independently managed sectors, there is a required need for coordination with other planning documents, each functioning at different levels. For example, this requires that the PCETs be relevant for both the PDU coordinated at the level of the EPCI and the *plan local d'urbanims* (PLU) at the scale of the *communes*, each of which must adopt climate-related decisions. As such, the need for coordination among adjacent authorities concerning climate action plans and processes may be necessary.

A second type of external coordination is required in terms of the development and implementation of climate policy and planning documents. This is the case in terms of coordinating between a centrally managed PCET, as is the case for both Grenoble and Nantes Métropole, and either downwards with the individual *communes* or upwards with the *département(s)* and the *région*, given that each level holds separate, but often linked, competencies. In some instances, the EPCI must find a means of either coordinating its climate action plans with that of other authorities or in cases where the other actors have not yet initiated an internal PCET process, incentivize action as *communes* continue to hold key competencies related to GHG emissions. For example, in Grenoble Alpes Métropole, a single *commune* (Saint-Martin-d'Hères) has chosen for political reasons not to participate in the PCETs coordinated by the Métro or initiate its own action on the subject (Uhry 2011). Further, this question of coordination among PCETs of different local authorities with overlapping territorial boundaries will need to be addressed as the *Grenelle II* legislation

[75] *Plan de déplacements urbains*

requires all local authorities governing 50.000 inhabitants elaborate PCETs.[76] As a number of *communes* within EPCI currently pass this threshold, further overlap could exist. While depending on the sector targeted for emission reductions, action at a smaller perimeter may be more effective, losing the clarity of action and engagement through a multiplication of climate action plans, efforts and authorities may confuse and dilute efforts.

Finally, an EPCI will need to coordinate actions with the private-sector actors and individual citizens, who are also important sources of emissions. While many of the largest private-sector emitters are already covered under the EU Emissions Trading Scheme, in many instances local authorities have attempted to engage them (as well as smaller emitters) in emission-reduction efforts. This can range from the creation of *plans de déplacements d'entreprise* (to treat emissions from the daily commuting of employees) to reduction of the operational emissions of the company itself. As such, it is important that local authorities are able to coordination actions internally and among themselves, but are equally able to engage the larger general public and economic actors.

3.1.3. Fragmented Objective: Differing Logics, Framing and Reasons for Acting

While coordination appears necessary to overcome the fragmented administrative and jurisdictional context, the large number of actors whose participation is necessary to achieve effective collective action surrounding climate change can complicate the adoption of convergent GHG-reduction targets. Each actor group tends to have different reasons for action and the framing of greenhouse gas-emission-reductions involves touching upon not only how the policy problem is understood (causes, effects) and relationships with competing objectives, but equally what solutions are appropriate.

Multiple Framing: energy versus sustainable development

Often, there are differences between whether reducing greenhouse gas emissions is framed principally as an energy-consumption problem or as being part of the larger sustainable challenge, thus equally touching on larger-scale questions of social justice and linking it with other environmental challenges. This framing can influence the type of policy solutions that are prioritized. For instance, when viewed as principally an energy-consumption problem, there is often a prioritization of technological solutions that reduce energy use, change fuel-types or capture and store emissions (Grange 10.03.02). In the case of transport policy, this leads to an emphasis on technology change (fuels, improved efficiency, etc.) and modal shifts, with less of an emphasis on reducing the demand for transport and mobility services through systemic changes in urban development as are often pushed for by those using a 'larger' framing (Pezet Kuhn 10.03.02). Even when similarities in approach are found concerning behavioral issues, differences in related policy priorities can influence what actions are seen as appropriate. For example, both urban planners and transport engineers recognize that density along transport lines is important to ensure the deployment of public transport. However, while the principal indicator for transport engineers is the distance of each resident from a transport station (bus, tram, etc.), urban planners often equally value the

[76] However, it should be noted that statutory PCET are required to treat only operational greenhouse-gas emissions with territorial emissions being optional.

negative impacts from increased exposure to air pollution due to the proximity to major transport corridors (Pezet Kuhn 10.03.02). As such, conflicts in terms of the prioritization of different social, economic and environmental factors among actors can limit the ability to achieve common objectives and appropriate actions.

However, barriers also exist in terms of framing the issue of climate change too widely, mixing it into a pre-existing multi-objective strategy from which it is difficult to formulate concrete actions, as was often seen in the cases of *Agenda 21* (Yalcin & Lefevre 2010). However, as noted by interviewees in the case of Grenoble, a new generation of elected officials is beginning to adopt a more-holistic framing of the climate-change challenge, leaving behind the idea often held by their predecessors that technological progress can solve all problems (Poimboeuf 10.03.01). Nevertheless, linkages often need to be found with existing policy priorities (so-called co-benefits) and a means of integration into an increasingly short-term policy time horizon linked to mandates and election cycles.

Differing Reasons for Action

Framing and finding common ground for action can also be linked to the justification for taking up climate change and greenhouse gas reductions to begin with. While, as seen in by Sippel and Jennsen (2009) as shown in Table 33, motivation can range far beyond strictly environmental reasons. Economic reasons, such as savings from energy-efficiency projects, to issues of livability, political and culture objectives as well as advocacy and the political positioning of individual actors, can lead to action for GHG mitigation. For example, Grenoble Alpes Métropole's long-running struggle with local air pollution and urban heat-island effects has created a policy context fertile to the adoption of greenhouse gases as an additional type of air pollution to treat.

Table 33 : Motivations for Addressing Greenhouse gas Mitigation by Local Authorities

Economic
Cost savings – *energy efficiency, other savings from co-benefits*
Business opportunity – *engineering firms and other actors offer technical assistance*
Livability
Air quality – *links with local air pollution*
Urban warming – *heat-island effect*
Political / Cultural
Internal pressure – *sensitivity of the population to environmental issues*
External pressure and trickle down – *formal- and informal-policy mandates*
Reputation – *build and communicate an image using climate-change issues*
Policy Trends – *"impossible not to treat climate change / next logical environmental subject to address"*
Larger Project – *federating element of a larger project, expansion of inter-communal territory, etc.*
Individual Policy Entrepreneurs – *individual actors may differentiate themselves with the subject*
Reinforce existing projects – *climate change as an additional reason to pursue an existing strategy or project*

Source: After Sippel & Jennsen 2009; Author's interview data

As such, climate policy has developed out of a long tradition of addressing air-pollution problems as well as real concerns on increasing negative impacts from heat-island effects. On the other hand, Nantes Métropole is less subject to issues of local air pollution, given its geographic location and the coastal winds that tend to reduce local-pollutant concentrations. As such, climate change appears to stem from both a long-running commitment to environmental issues as well as the involvement of the EPCI at the European and international level. The president of Nantes Métropole has consciously aimed to develop a climate action plan equal to its desire to improve its visibility and role at the European level (Guillard 10.12.07).

It is important to recognize that GHG mitigation may not be seen as an objective in and of itself, but rather a means to an end. GHG mitigation may, rather, be framed as a positive co-benefit of other, linked, policy priorities (local air pollution, accessibility goals, and development of new economic sectors). Similarly, GHG mitigation may add increased validity to an already-selected course of action that presents synergistic characteristics (i.e. proliferation of public-transport projects in general). This can facilitate mitigation as emission reductions give further weight and importance to achieving existing objectives (LeGal 10.12.08). Nevertheless, it is important to recognize and instill the importance of GHG mitigation, as this "piggybacking" may limit the "mainstreaming" or integration of concern for GHG emissions widely into the general decision-making process (see Chapter 5). As such, this may not give rise to many of the systemic changes needed to achieve state, and ambitious, GHG-mitigation objectives. Given that how issues are framed tends to shift over time (LeGal 10.12.08), it is important for GHG-emission reduction to be seen at least as a criterion for analysis, if not an important priority, in and of itself.

3.2. Limitations on Resources for Governance: Capacity, Information and Finance

Limitations on the resources necessary to govern greenhouse gas mitigation, as well as other climate-related subjects, influence the capacity of actors to achieve climate-change objectives. These limitations stem from the limits on the technical capacity of actors, the availability of expertise and information, as well as the available financial resources.

3.2.1. Capacity Limits: Technical Expertise to Understand the Impact of the Sum of Actions

Insufficient scientific, technical, and implementation capacity on the part of actors, whether local or national, can limit ability to foster greenhouse gas mitigation. As show in Table 34, a number of limitations in terms of analytical limits, implementation and workload capacity can be observed in the French context.

Table 34: Capacity Limitations

Analytical Limits	- Evaluation of impacts of GHG-mitigation actions - Analysis interaction among sectors (i.e. transport and urbanism) - Identifying systemic effects (i.e. network effects of actions) - Conducting multi-criteria analysis
Implementation	- Translation of orientations into actions and policy prescriptions - Assuring coherence among sectors (mainstreaming)
Workload	- Assuring oversight/follow-up of sectoral activities - Providing technical assistance

Analytical Limits

Actors working at any level of government are often confronted by a number of analytical limits that may be further exacerbated by limitations on internal-technical capacity found at the local level. First, the quantification of emission reductions in some sectors, such as transport, may require the collection of significant quantities of data and the use of sophisticated modeling tools beyond their reach. Thus, a lack of technical training, methods, as well as resources (time and money) can limit the technical capacity applied to the analysis (Pezet Kuhn 10.03.02). Further, identifying and prioritizing what actions to take in the first place is often difficult due to both the scope of the problem and given interactions among sectors. In both Nantes and Grenoble, actors noted difficulties in evaluating how daily activities and choices affect GHG emissions and other systemic effects of individual or groups of actions. Finally, the production of information regarding both the actions to take and the impact of these actions can be complicated by the need to conduct a multi-criteria analysis, placing climate change in perspective with other policy priorities to identify potential double dividends. This touches on a larger difficulty found in attempting to integrate sustainable-development criteria into decision-making processes across not only individual actions, but across the entire lifespan of a project or investment (LeBras 10.10.22).

Implementation

At the implementation stage, a number of capacity limitations can affect the ability for actors to reduce their emissions. First, there are often difficulties in the translation of orientations and larger strategic objectives into concrete actions and policy prescriptions. This can stem from a lack of a common set of metrics to the integration of greenhouse gas mitigation into decision making around actions (explored in Chapter 5) (Favrolt 10.10.19). Or local authorities may have increasing difficulties in identifying further means of reducing GHG emissions in a number of sectors, such as the transport sector (see Chapter 3). Second, a number of implementation challenges are encountered in ensuring coherence among sectors, effectively requiring a "mainstreaming" of GHG-mitigation logic into all policy areas. Difficulties have been encountered in establishing long-term cooperation among the actors from different sectors to ensure that that GHG mitigation is not just a policy 'fad' that will be treated punctually, but not systemically (Favrolt 10.10.19).

Workload

Part of the difficulties to address GHG mitigation may be related to the workload that is implied, as often a small department or group of actors is charged with following a wide range of environmental subjects simultaneously as well as ensuring that they are more widely integrated into other policy sectors and existing actions (Poimboeuf 10.03.01). This can apply to the workload of departments dedicated to environmental issues, but also for other actors who must perform additional tasks. For example, the implementation of data collection linked to a tracking of spending on climate-related subjects (*tableau de bord*) under development by Grenoble Alpes Métropole has been hindered by difficulties in convincing administrative services to apply a climate action-plan classification code to specific actions in tracking and accounting documents (LeBras 10.10.22) (Poimboeuf 10.10.20).

3.2.2. Information Limitations: Measuring to Manage

Coordinating action around greenhouse gas mitigation requires a flow of information among actors concerning commitments, effort and progress. As greenhouse gas mitigation is a relatively new subject, few, if any, local actors were calculating their emissions even a decade ago. As such, a limitation in terms of the development and use of GHG data and information can exist among actors both across and within levels of governance.

Managing greenhouse gas emissions requires at least a rudimentary level of quantification to identify sources of emissions, actions to take, and progress towards reduction goals (see below). However, if a common "language" is not found to communicate on these issues, information asymmetries can develop among actors across and within levels of governance as well as among the EPCI and private companies and individuals. Choices made concerning what types of greenhouse gases to include, how sectors are defined, what emission scopes to include, as well as definitions of weighting and explanations for weather and economic trends, can lead to a significant variety of results. As such, basic harmonization of quantification methods appears necessary to ensure that all parties involved in greenhouse gas-emission reduction have a common understanding both within and across levels (see Chapter 6).

3.2.3. Funding Limits: Understanding What Part of GHG Financing Is "Additional"

Part of the limitations above stem from what often underlies governance challenges at all levels: insufficient financial resources undermine effective implementation of policy. However, when finance is available for climate-relation actions, there tends to be a relatively high level of complexity linked to financial models used to distribute funds as well as difficulties in identifying the added cost of reducing GHG emissions.

Table 35: Funding Limitations

Insufficient & Variable	- Scope of investment needed - Periodic nature of subsidies and call for projects
Complexity	- Identification of additional costs linked to GHG reduction - Complex financial models

Insufficient & Variable

As opposed to other statutory responsibilities mandated to local authorities in France, climate-change policy has no operational subsidy (*dotation*) or set amount of money transferred from the State to the lower levels of government. To date, little dedicated financing has been made available from the State to sub-national authorities besides limited subsides from the ADEME and other State agencies for the elaboration of PCETs and conducting greenhouse gas inventories. Often, financing is not offered for specific GHG-mitigation channels, but rather funneled through existing sectoral mechanisms (i.e. transport, building, etc.) with GHG mitigation being a co-benefit of the funding of other policy priorities. As such, funding tends to be project-based and, thus, limited to the cycles of call for projects as well as the total amounts set aside by organisms for climate-related actions.[77]

While in some sectors, such as transport, financing may often be available, in other sectors, such as housing where large-scale renovations are necessary across the entire built stock in the urban area, less funds tend to be offered (Pezet Kuhn 10.03.02). In many instances, as seen in the case of the Ville de Nantes, local authorities have difficulties in fostering climate-related works, such as the renovation of the housing stock, while at the same time keeping to the planned rhythm of development and targets as set out by different strategic documents (PLH, SCOT) (Boesflug 10.12.06). When climate-specific funding is available, it is often limited to the planning stages, but frequently does not cover the implementation stages of projects (Albert 10.12.09). Further, given the need for local authorities to foster the cooperation among services and across actor groups, funding is equally lacking for the accompaniment of the larger PCET dynamic described below. The lack of stable financial flows can limit efforts in achieving the mainstreaming of GHG mitigation across policy sectors.

The Technical Complexity of financing Climate Action

Problems financing GHG mitigation are further exacerbated by the complexity of reducing greenhouse gas emission. On the one hand, local authorities in both Grenoble and Nantes indicated that there is a real difficulty in answering what is the additional "cost" of integrating GHG-emissions mitigation into existing policies or projects. For budget management, whether when measuring investment performance or communicating on dedicated spending, identifying what portion of investment serves to reduce GHG emissions is crucial. However, stating how much, for example, of the total cost of the creation of a tramway line should be attributed to the cost of the climate action plan is difficult in practice (Poimboeuf 10.10.21; Guillard 10.03.02).

Further, while a set of market-based mechanisms has been developed both at the European scale as well as in France, their use often remains technically challenging. The European Union's support of joint implementation[78] projects in the EU has led to the development of the domestic-projects framework in France. Projects judged "additional" in terms of GHG emission reduction are eligible to generate emission reduction credits that can be sold in the carbon markets. France has equally created its own *certificats d'économie d'énergie* through which municipalities can monetize energy-efficiency projects in buildings through the sale of certificates to energy producers. Other fiscal tools have also been deployed to incentivize action, such tax credits and preferential rates for loans for targeted investment. However, the current sources of GHG-mitigation financing often requires a high level of technical financial expertise (project development, risk sharing, and evaluation) that goes

[77] National funding in France tends to lie along sectoral lines. For example, the *Fonds déchets* (waste) will provide 571 million Euros to municipalities between 2009-2011 to reduce and improve the management of waste. The *Fonds Chaleur*, managed by the ADEME, aims to use the targeted investment of 1 billion Euros in renewable energy projects between 2009-2011.

[78] Joint Implementation (JI) allows for investment in emission-reduction projects in Annex B countries party to the Kyoto Protocol. These projects convert host country Assigned Amount Units (AAUs) to Emission Reduction Units (ERUs), which are delivered to investors.

beyond the capacities of many local authorities.

3.3. Implications for Facilitating Collective Action and GHG Mitigation

This section has looked at how the large multi–level governance context for climate policy in France can create a number of barriers to the reduction of greenhouse gas emissions at the local level. As seen above, *administrative fragmentation* can limit the federating of the actors necessary to reduce greenhouse gas emissions. *Jurisdictional fragmentation* leads to a fragmented decision-making and implementation context within which coordination of the relevant parties becomes difficult, if not impossible. Differences in *objectives and priorities* can form when issues are framed and perceived differently, thus suggesting that forms of interaction fostering learning are necessary to arrive at common framing and objectives among actors. Limitations on the different resources necessary for governance can equally reduce the capacity to reduce GHG emissions. *Information limitations* limit the understanding of individual actors concerning their role in reducing emissions. Further, limitations can create information asymmetries among actors, making coordination difficult, suggesting that a common metric(s) or language is necessary to facilitate information sharing. *Capacity* limits affect the technical abilities of the heterogeneous actors to develop and implement necessary policies. *Funding limits* and the various issues related to the calculation of the needs for resources for action limit the ability of actors to engage the issue fully, as shown in Table 36.

Table 36: Impacts of Gaps on the Ability of Local Authorities to Reduce GHG Emissions

Fragmentation of Governance Context	
Administrative Fragmentation	Ability to define the perimeter of responsibility for GHG emissions Ability to coordinate among different actors and institutions functioning at different perimeters
Jurisdictional Fragmentation	Ability to coordinate the range of actors: internally across services and externally across services and institutions functioning within and among levels of government
Objective Fragmentation	Prioritization of climate in relation to other subjects Identification of acceptable solutions
Limitations on Resources for Governance	
Capacity Limitations	Ability to evaluate: impacts of GHG-mitigation actions; interaction among sectors; systemic effects Ability to perform multi-criteria analysis Ability to translate general orientations into actions and policy prescriptions Ability to ensure coherence among multiple and diverse policy sectors (mainstreaming) Ability to provide necessary levels of oversight and technical assistance
Information Limits	Ability to track, measure and communicate: objectives, means, progress and final results Ability to identify actions and levers to reduce greenhouse gas emissions
Funding Limits & Fragmentation	Ability to identify additional costs linked to GHG reduction Ability to secure the level of financing necessary Ability to manage the complex nature of the financial mechanisms

The above sections confirm that, as seen in the literature, in France institutional, policy and framing barriers, combined with capacity limitations within the multi–level governance context for climate change, present a number of barriers towards implementing GHG-mitigation policies. There appears to be a clear need for coordination both across and among levels of governments, sectors, etc. to foster the collective action necessary to reduce greenhouse gas emissions. The next section will analyze the climate action plans, the principal tool developed to coordinate GHG mitigation to date by local authorities, drawing on the cases of Grenoble Alpes Métropole and Nantes Métropole. Their experiences can indicate how these barriers to collective action and behavioral change are being addressed and overcome as well as what efforts still must occur.

4. GOVERNING GHG MITIGATION: THE KEY ROLES OF CLIMATE ACTION PLANS AND GHG EXPERTISE

Developing capacity to address the barriers described above is an essential part of moving local climate policy forward. The literature points to a number of factors supporting local capacity, including delegated government functions and roles; key actors and institutions; as well as tools for decision-making (Adger et al. 2009; Moser 2009a; Bulkeley et al. 2009; Betsill 2001; Qi et al. 2008; Schreurs 2008; Sugiyama and Takeuchi 2008). To date, the principal means of organizing the governance of GHG mitigation at the local scale is through the development and implementation of climate action plans. Rather than a list of actions necessary to reach GHG-mitigation objectives, these plans tend to create an ongoing process focusing on actions to reduce emissions, but more largely the federation of actors from across the territory in prioritizing GHG mitigation. Within this process, information tools, expertise and methods for monitoring and evaluating are important to support further action. The following section analyses the different actions and processes put into place as part of the larger climate action plans. Applying the robust environmental governance framework (Dietz et all 2008, see Chapter 1) to the organization of climate action, the analysis identifies lessons for the polycentric governance of a complex transversal issue requiring both collective action and coordination of actor groups.

4.1. Climate Action Plans: Leveraging Strategies, Actions and Engagement

While no single model exists across or within countries, a climate action plan is typically characterized as a document written by the local authority and setting out emission-reduction objectives as well as the identification of the actions to achieve the desired reduction. While national regulation in France requires that local governments treat only internal (corporate) emissions, many have chosen to address community-wide emissions from their administrative jurisdiction. More recently, going beyond individual actions, in many cases, policies and mechanisms have also been established to interface with both internal and external actors to facilitate a wider reduction of their greenhouse gas emissions. To date little systematic study of a large sample of climate action plans has occurred to understand their structure and functioning. Internationally, one of the most comprehensive analyses is Harriet

Bulkeley et al.'s 2009 study of 10 major urban areas.[79] Similar to the analysis of the barriers to action conducted above, their research has pointed to the importance of how the issue is framed by local actors with different definitions of the problem often in competition either with each other (i.e. energy vs. larger sustainable development) as well as with competing policy topics (Bulkeley et al. 2009). However, their research does not address institutional and organizational issues, focusing instead on the role of "leadership" access to financial issues and jurisdictional boundaries.[80]

In France, climate action plans, or *plan climat energie territorial* (PCET) as they have been christened by the *Grenelle II* legislation, follow a similar structure as observed internationally. French national legislation stipulates that PCETs should be built upon existing Local *Agenda 21* when already in place. However, as many researchers have noted, PCETs are typically very different from Local *Agenda 21*s.[81] Both Yalcin & Lefevre (2009) and Criqui & Lefevre (2010) note that *Agenda 21*s have been seen as too general, serving to increase awareness on sustainable-development topics, but not honed enough to lead to the implementation of actions whose performance can be clearly evaluated. PCETs, however, tend to be much more action-oriented documents focusing on energy-related emissions.

This has been seen in the physical documents examined in the two cases studied here and equally in the 2011 CERTU study of over 30 PCETs in France. First, the PCETs identify the strategic framework to guide climate policy. This typically includes the establishment of quantified emission-reduction objectives as well as time horizons. The strategic framework equally identifies the stakes, purpose and priorities to guide the implementation of the PCETs. In the case of Grenoble Alpes Métropole, the strategy outlined in the PCET focuses on the federation of actors, sharing resources and tools, fostering exchanges of experience and establishing coherence in mitigation action. Second, once the larger strategic framework is presented, the PCETs outline the organization of action. This typically includes not only how GHG mitigation (and often adaptation to climate change) will be organized and treated internally, but also how the local authority will work with external actors. Third, a PCET will then identify the actions to reduce GHG mitigation both internally (corporate emissions) as well as community emissions within their administrative boundary. Key areas of focus (transport, building emissions, waste, etc.) and accompanying principal actions (*actions phares*) are identified, often linked to the direct competences of the authority. A second set of

[79] This included case studies of Beijing, Cape Town, Hong Kong, Yogyakarta, New Dehli, Melbourne, Mexico City, Mumbai, Sao Paulo, and Seoul.

[80] More recently, a number of gray-literature reports have been conducted, often looking at technology-oriented issues. A recent report by the World Energy Council (2010) as well as by GlobeScan and MRC McLean Hazel for Siemens (2010), have produced a number of interesting case studies containing a large quantity of valuable information on both the challenges faced by urban areas as well as the solutions that have been identified. However, both take a markedly technology-oriented approach to analyzing the problem with little in-depth analysis of the institutional and coordination mechanisms put into place to foster progress.

[81] Local *Agenda 21*s are the application of the UN *Agenda 21* program by local authorities. These programs aim to introduce the three pillars (social, economic, and environmental) of sustainable development into local-scale policy making. In France, their development has been supported by the State as well as State agencies, such as the ADEME.

actions are equally identified to foster external action, either through education and informational programs to inform actors, demonstration projects or the targeted direct intervention (financing, technical support, programs). Finally, a PCET typically outlines how progress towards goals will be evaluated and tracked.

Table 37 : Parts of the Components of a Climate Action Plan

	Example of Components
Strategic Framework	
Objectives	- GHG, energy use and renewable-energy production
Calendar	- different goals with different time horizons
Stakes / purpose	- identification of principal stakes (federate actors, share resources and tools, exchange experiences, establish coherent actions)
Organization and Coordination	- Internal coordination (between departments and agencies) - External coordination (engaging private-sector actors
Actions, Policies and Programs	
Internal	- Identification of key areas and principal policies (i.e. transport, residential, economic-development, waste-management)
External	- Foster external action through education, information, demonstration projects, technical support
Evaluation / Tracking	- Development of an observatory or other means of tracking progress towards goals

As such, rather than a plan stipulating what specific actions are necessary to achieve emission reduction targets, a PCET appears to function more as a common strategic definition of how to work institutionally towards objectives and what actions will be initially prioritized. While it is important for PCETs to be realistic in terms of objectives and expected contributions from various actors, they appear to focus principally on setting a larger framework to install a culture of carbon to foster interaction, engagement, and voluntary commitments across the entire territory. As such, there is a recognition that PCETs will evolve over time as local actors further appropriate and integrate or mainstream GHG mitigation into both internally and externally focused policies. As Yalcin & Lefevre note, "Their [PCET] originality lies particularly in the way they reposition initiatives (which have often already been launched, but are conducted in an isolated manner) in a sustainable framework with the aim of meeting targets that are both specific (quantified and assessable) and ambitious (in line with national and European measures)" (2009:7).

Table 38: Typology of *Agenda 21*s and Climate Action Plans

	Agenda 21	**Climate Action Plan**
Stage 1	- communication and outreach	- diagnostic of emissions - communication and internal, didactic learning
Stage 2	- demonstration projects - pedagogical functions and learning	- transversal coordination and development objectives with internal services; external partners - definition and quantification of means of achieving objectives
Stage 3: Maturity	- implementation of SD strategy - « less discussion, more action »	- mainstreaming of consideration for GHG emissions into generalized policy making - benchmarks and indicators to track progress - establish linkages between GHG benefits and co-benefits

Source: Author after Emelianoff 2010 and Criqui & Lefevre 2010.

While different from *Agenda 21*s, the typology for their evolution developed by Cyria Emelianoff (2010) (Table 38) can be rethought to analyze PCETs. Drawing on experience from the cases studied here, as well as Criqui & Lefevre's nascent typology for classifying different "stages" of development of climate action plans focusing principally on quantification,[82] three stages of development can be identified. In the first stage, a period of learning occurs during which the different actors conduct diagnostics of their emissions as well as work to understand better the larger GHG-mitigation challenge. The second stage focuses on the development not only of quantified objectives, but equally establishing the transversal coordination necessary to do so in a discursive manner fostering trust among the actors involved. This coordination involves both internal services, but equally external actors. In the third or "mature" phase, what was initially a centralized process becomes more diffuse: GHG mitigation is integrated or "mainstreamed" into individual policy-making processes. With support from a centralized service, benchmarks and indicators are developed with the different actors to track progress. Finally, and perhaps most importantly, GHG-mitigation benefits are fully linked with other, often more pressing, policy objectives or 'co-benefits.'

Below, the climate action plans from Grenoble Alpes Métropole and Nantes Métropole are briefly described and then summarized in Table 39. A more detailed description and presentation of each of the two PCET processes can be found in Annex 6.

4.1.1. Grenoble Alpes Métropole: A Communauté d'Agglomération Working in a Decentralized Context

Initially passed in 2005, and subsequently revised for the periods 2008-2010 and 2010-2014, the *Plan Climat* of Grenoble Alpès Métropole (*La Métro*) has established ambitious GHG-emission-reduction targets operating at different timescales for the territory under its jurisdiction. Current targets set in the short run (2014) aim to achieve a 14% reduction in CO_2 emissions within their jurisdiction compared to 2005 levels. This equates to a 9% reduction of the operational emissions of the *communauté d'agglomération* (C.A.) for 2014. Medium-term goals for 2020 adopt the European Union objectives of a 20% reduction in emissions. Finally, *La Métro* has adopted the national long-term objective of achieving the *Facteur 4*-emission reductions for 2050, since the 2009/2010 climate-change policy is coordinated by the *'Project Environnement'*, part of the transversal *Direction du pilotage de la performance gestionnaire et environnementale*. This transversal service, under the direct authority of the Director General of Services of *La Métro*, was created to introduce a logic of economic efficiency as well as an environmental perspective into the ensemble of the five principal directions.[83] As demanded for all actors engaged in *La Métro's climat* action plan, the *communauté d'agglomération* has elaborated a set of actions focusing on the reduction of

[82] In the early stage, a process is started leading to the quantifying of GHG-emission-reduction objectives. In a second stage, a MRV(measureable, reportable, verifiable) reporting system is developed, typically accompanied by the creation of an 'observatory' body to monitor progress towards mitigation goals. In the third stage, a cost/benefit logic is introduced into the selection and implementation of actions based on the ability of local authorities to develop and use marginal abatement-cost curves (Criqui & Lefevre, 2010:464).

[83] Principal Directions : Attractiveness and sustainable urban development; Socially sustainable growth; Transports and mobility; Technical services and urban quality; Resources and means.

internal, operational emissions targeting its jurisdictional competencies and operations: sanitation services, waste management, owned buildings. External coordination of greenhouse gas emissions principally occurs through the use of the *chartes d'engagement*, or a voluntary contract between each individual partner, *La Métro* and the *Agence Locale d'Energie et du Climat* (ALEc). Thus each partner, whether public or private, is formally engaged within the climate action process. The ALEc manages coordination with partners as well as the engagement of the general population in the climate action-plan process.

4.1.2. Nantes Métropole: The Centralized Action of a Communauté Urbaine

The climate action plan of Nantes Métropole, first approved in 2007, stems from close to a decade of previous work on energy and sustainable-development-related issues by the *communauté urbaine* (C.U.). The *Cadre Stratégique du Plan Climat Territorial* was passed in 2007, setting out the larger strategy and framework for climate action. Within this framework, the C.U. wishes to reduce emissions across the territory by 50% by 2025 and by 75% by 2050, using 1990 levels as a baseline. Today, this translates into the reduction of approximately a total of one million tons CO_2e by 2025, or 55,500 tons CO_2e annually. However, to date these objectives have not yet been broken down by departments and services in terms of the attribution of specific GHG-reduction targets (Guillard 10.12.07). Achieving high-level attention, the director of the climate action-plan project is officially the Assistant Director General of the *communauté urbaine*, with heavy oversight by the Director General of all departments since 2008 (Guillard 10.12.07). The "*chef de projet*" is the head of the newly-created five-person *Service Animation Développement Durable et Climat* embedded within the *Direction Générale Environnement et Services Urbains*. Internal coordination occurs principally through the existing working structure stemming from the development and implementation of the various *Agenda 21* processes. As a *communauté urbaine*, Nantes Métropole holds more jurisdictional competencies (and has a formalized hierarchical relationships with the individual communes) than Grenoble Alpes Métropole (*communauté d'agglomeration*). The *Service Animation* uses the existing institutional framework and networks within the C.U. to coordinate policy with individual communes. The principal engagement of *communes* occurs not only through the approval of the *Cadre stratégique* and subsequent individual climate action plans, but also through the adoption and ratification of the participation of Nantes Métropole in the *Covenant of Mayors* program. This has set GHG-reduction objectives in line with the Covenant of Mayors' EU 20/20/20 targets[84]. To engage a larger swath of the private and civil-society actors across the territory, Nantes Métropole has developed a number of additional programs often bringing together a range of different actors.

[84] Recognizing the importance of cities and local authorities in achieving its ambitious goal of reducing GHG emissions by 20% by 2020, the European Union launched the Covenant of Mayors initiative in January of 2008. A results-based voluntary process targeting cities and regions, signatories of the covenant formally commit to reduce their CO2 emissions by more than 20% by 2020. The Covenant of Mayors requires that signatories develop Sustainable Energy Action Plans (SEAPs) using a quantified GHG inventory and baseline as a point of departure.

Table 39: Climate Action Plans of Grenoble Alpes Métropole and Nantes Métropole (see Annex 6 for detailed descriptions)

	PCET Grenoble Alpes Métropole		**PCET Nantes Métropole**	
Document Timeline				
Timeline	1998 – Creation of the *Agence Locale de l'Energie* 2001 – GHG inventory conducted (based on 1999 levels) 2005 – Approval: *Plan Climat* (16 February) 2006 - *Plan de Protection de l'Atmosphère* (PPA) 2008-2010 – Engagement Period 1 of PCET (stabilization) 2010-2014 – Engagement Period 2 of PCET (-14% 2014)		2003-2006 - Contract *ATEnEE ADEME* -Nantes Métropole 2006 – Approval of the *Agenda 21* 2006 – Approval: *Plan Pluriannuel d'Actions pour l'Energie* (PPAE) 2007 – Strategic Framework of *Plan Climat Territorial* 2009 – Second Phase of PCET (transversal and community engagement)	
Objectives				
	Operational (Internal)	**Territory (Jurisdiction)**	**Operational (Internal)**	**Territory (Jurisdiction)**
Short/Medium-Term	2014: - 9%	2014: - 14% 2020: - 20 %	*Not defined*	2025: - 50 %
Long-Term	*2050: Facteur 4* (-75%)			
Reference Year	2005		1990	
Institutional Structure				
Principal EPCI Actors	- *Projet Environnement*, based on the transversal *Service Pilotage et Evaluation*		- *Service Animation Développement Durable / Climat – Direction Générale Environnement et Services Urbains* - Central coordination by *Directeur Général des Services*	
Political Decision	- *Conseil Communautaire*		- *Conseil Communautaire* - *Groupe Pilotage Strategique du PCET*	
Political Support	- Jean-Marc Uhry, *Vice-Président à l'environnement, au développement durable, au climat et à l'énergie*		- Ronan Dantec, *Vice Président Nantes Métropole / Adjoint au maire de la ville de Nantes*	
External Coordination	- *Agence locale de l'energie et du climat*		- *Pôles de proximité* - *Agenda 21* network of "referents"	
Technical Support	- Scientific Committee - Urbanism Agency – AURG (L'Agence d'urbanisme de la région grenobloise) - ASSQA – ASCOPARG (Association pour le contrôle et la préservation de l'air en région grenobloise)		- Scientific Committee - ASSQA - *Air Pays de la Loire* (relatively recently involved)	
Expert Groups	- Scientific Committee - *La Commission Environnement*		- Scientific Committee	

Evaluation	- Observatoire du Plan Climat	- *Service Animation Développement Durable / Climat*
Coordination Mechanisms		
Internal Coordination	- European Energy Award (*Cit'ergie*) (2007) - *Plan d'Actions Transversal* (PAT)	- 100 Actions - *Mobilisation des politiques publiques* - European Energy Award (Cit'ergie) – limited to Ville de Nantes
External Coordination	- *Charte d'engagements* - ALEc– annual reporting and assistance with develop action plans (principally with communes) - Technical assistance	- *Pôles de proximité* - Technical assistance - *Groupes thématiques*
General Public (in development)	- ALEc – information and counseling services, target project actions	- *Allo Climat* – information hotline - *Ecopôle* – resource and counseling center - *L'Espace Info Energie* (EIE) - *Atelier Climat*
Budget Tracking	- *Tableau de bord* including GHG-emissions indicator (under development)	- *Compteur carbone* (early phase of PCET, discontinued)
Evaluation		
GHG Quantification	- Annual GHG inventory data (N-1) - Project-based evaluations (life-cycle analysis)	- Punctual territory-wide GHG inventories (most recent in 2007) - Project-based evaluations (life-cycle analysis)
Actors	- *Observatoire du Plan Climat* (part of the *Agence Locale de l'energie*)	- *Service Animation Développement Durable / Climat*
Public Forum	- *Forum du Plan Climat* (bi-annual meeting)	- *Rendez-Vous Annuel Climat*

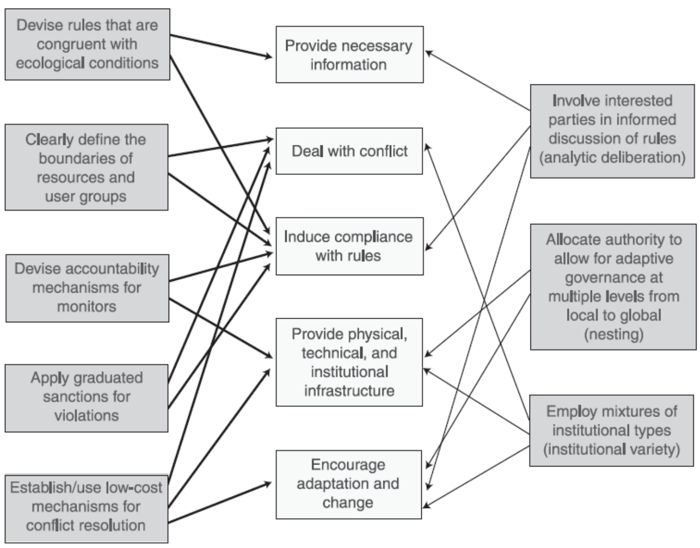
4.2. Lessons from Case Studies: Towards Robust Polycentric Climate Governance

As described in above, both Grenoble Alpes Métropole and Nantes Métropole have developed institutional structures and deployed a number of policy mechanisms to facilitate the collective action necessary to reduce greenhouse gas emissions. While other studies have analyzed the types of specific mitigation actions implemented through PCETs (see CERTU 2011 for close to 1,500 actions identified), little analysis of the institutional process put into place has occurred. Taking different approaches to the coordination, engagement of partners and provision of technical expertise, the two institutional models confront, if not overcome, the barrier to the governance of GHG mitigation stemming from both the multi–level context as well as the operational-governance challenges to achieve transversal coordination and action. This section will look at how institutional mechanisms are being used to overcome the fragmentation identified in Section 3. The following section, then, will analyze the role of informational tools.

4.2.1. Robust Environmental Governance Framework

The evolution of a PCET appears to start with the development of a list of actions and moves towards the development and integration of GHG mitigation into sectoral decision making. While the climate action plans in and of themselves as strategic frameworks and identification of actions are important, what seems equally important are the means of leveraging and coordinating the emission-reduction efforts of individual actors. As explored in Chapter 1, Deitz et al. (2008) has established a framework for analyzing the governance of environmental (or other) common-pool resources. This framework, as seen in Figure 16, presents a number of principles for robust governance as well as what their research has identified as governance requirements.

Figure 16: General Principles for Robust Governance (Right and Left) and Governance Requirements (Center)



Source: Deitz et al. 2008

As seen in Table 40, the application of this framework to the management of greenhouse gas emissions helps to reveal a number of specificities that must be dealt with to foster collective action. First, managing greenhouse gas emissions appears to require significant information not only on GHG-emission sources, but also in terms of what mitigation options exist, as well as how they can be implemented and financed. Second, conflicts over direct resource use (and abuse) are not a significant issue given that it is the *sink for emissions* rather than a *stock of emissions* that must be managed. Nevertheless, conflicts can be present among actors engaged in the GHG-mitigation dynamic concerning difference in objectives, prioritization of subjects as well as what are perceived as appropriate tools and courses of action. Third, participation in GHG mitigation at the local level is, to date, principally voluntary and sanctions for non-compliance are often limited to reputational issues with limited punitive sanctions. Thus, additional methods to induce compliance must be found. Fourth, climate change often requires transversal coordination across multiples sectors, services, levels of government and institutions, thus necessitating the development of institutional models and "infrastructure" to facilitate long-term coordination. Technical and physical infrastructure, in terms of models, methodologies as well as physical investments and construction, are equally often to facilitate the analytical as well as the operational shift towards low-emission-development pathways. Finally, given the complexity of climate change in terms of the numbers of actors, range of subjects, time horizons, the experimentation with multiple and often innovative governance structures flexible enough to adjust to changes in the long-term is important. However, what must be kept in mind is that no "optimal" solution or organizational models exist to overcome these challenges as both macro- and micro-contextual elements are important (Charbit and Michalun 2009; Foster 1997; Poteete et al. 2010).

Table 40: Robust Environmental Governance and GHG mitigation: examples from two case studies

Requirement	Climate Specificities	Grenoble Alpes Métropole	Nantes Métropole
Provide necessary information	Provide information on: - GHG emission sources - mitigation options - financing and implementation	- Yearly GHG inventory (various types) - Rough quantification of communal action plans by the ALEc - ALEc – other forms of education and information	- Periodic Territorial GHG inventories - Quantification of policies and actions of the C.U. (100 Actions) - Internal seminars to clarify messages and frame information -
Deals with conflict	Types of conflict: - Over-arching objectives - Relative prioritization - Appropriate tools	- Discussion Forums: bi-annual *Form Plan Climat* - European Energy Award – discussion among groups / services	- *Agenda 21* Structures – building trust / coordination - Thematic groups – engage different actors from the sectors - *Rendez-Vous Annuel Climat*
Induce compliance with rules	- Participation is principally voluntary - Limited reputational risk - Accompanied with punitive sanctions	- *Charte d'engagements / Plan d'actions* – elaborated document that sets some form of commitment / engagements - Monitoring: yearly follow-up from ALEc - Yearly meeting / reporting	- Yearly meeting and reporting of progress - *Bilan Carbone®* of certain activities (limited) – quantified follow-up
Provide physical, technical and institutional infrastructure	- Climate often requires - Transversal coordination across sectors, services, levels and institutions - Technical quantification and evaluation methodologies - Long-term physical infrastructure investments	- ALEc – consulting and aid to move forward - Long-term partnerships with expert organizations (AURG, ALEc, ASCOPARG) - *Conseil Scientific*	- *Conseil Scientific* - Number of different communication tools (*Allo Climat*, ECOPOLE, *Atelier Climat*, etc.)
Encourage adaptation (in governance) and change	Multiple approaches due to complexity: - Range of issues treated - Range of actors involved - Time horizons (staying the course and keeping actors involved) - Experimentation with new types of policies	- *Tableau de bord experimentation* - Reorganization of services and transversals measures - European Energy Award - *Charte d'engagements*	- Creation of centralized climate unit - *Decentralized Pôles de proximité* - *Agenda 21* Network

Source: Author after Dietz et al. 2008; interview data

4.2.2. Reducing Fragmentation through Flexible Institutional Infrastructure

Both Nantes Métropole and Grenoble Alpes Métropole use multi–level authority and institutional variety in the governance of GHG mitigation. The institutional mechanisms and process that have been put into place have aided the EPCI in overcoming the fragmented institutional context described above.

Grenoble Alpes Métropole provides a clear example of governing GHG emissions in a multi–level fashion through a partnership-based process. While internal efforts to address fragmentation focus on the network of actors involved in the European Energy Award Certification[85] (*Cit'érgie*) and the transversal-action programs targeting sectors over which the C.A. has substation control (see Annex 6), the principal coordination tool is the *Charte d'engagement du plan climat* process. The *Charte d'engagement* is a voluntary contract between each individual partner in the PCET and *La Métro* engaging the entity, whether public or private, within the climate action-plan process. As of 2011, over 70 partners had signed on, including *communes,* private companies, public agencies such as the SMTC (*Syndicat Mixte des Transports en Commun Agglomération Grenobloise*), universities, as well as the *Conseil Général de l'Isère* (the *département*). By signing the *Charte*, each actor engages to work towards the global GHG-emission-reduction targets established for the territory, as well as develop an internal action plan to reduce its own direct emissions stemming from activities and competencies. Signatories also engage to use their resources to communicate and work with their partners and clients (in the case of the *communes*, directly with the general public) to foster learning on GHG mitigation and mitigation action.

Each signatory works with the *Agence locale d'énergie et du climat* to establish emission-reduction objectives and an action plan. As explored below, each action is quantified in a rough manner to understand its GHG-reduction potential. Again, working with the ALEc, progress towards meeting mitigation goals is reviewed annually and discussed during the bi-annual *Forum du plan climat*. By working with a range of actors functioning at the levels of the EPCI or of a single *commune*, Grenoble leverages the capacities and competencies of each partner while at the same time providing them with needed technical expertise and assistance to develop and implement actions through the ALEc. Currently, the partners are working towards their 2014 engagements in terms of energy use and emission reductions. However, the commitment of each municipality in terms of energy consumption and emission of greenhouse gas reductions focuses only on their own buildings and their fleets of vehicles, given that they control these directly. However, this represents only a small portion of energy consumption of the territory, since it is the municipal assets. (Poimboeuf 10.10.21).

Nantes Métropole has equally developed an institutional process working across

[85] The European Energy Award is a certification processes that promotes the systematic review of all energy-related activities by a municipality. Structured around the process of identifying the actions that can be taken and understanding the potential means of action, the European Energy Award allows municipalities to identify strengths, weaknesses and potential for improvement and, above all, implement effectively energy-efficient measures. Using a standardized benchmark among participating communities, the award is given after a tri-annual review. See Annex 6 for further information.

multiple levels that structures the *communauté urbaine*. First, focusing on improving internal coordination by capitalizing on existing institutional structures, Nantes Métropole has profited from the pre-existing network of actor involved with the *Agenda 21* program. This network of '*réeféerants thématiques*' have been identified across the different directorates of the *communatuté urbaine* as well as the individual *communes* that make up the C.U. Through the network, the different actors coordinate with the *Service Animation Développement Durable et Climat* to integrate an analysis and understanding of greenhouse gas mitigation into the different policy streams. For example, in the development of the 2010-2015 PDU, the *Service Animation Développement Durable et Climat* worked closely with their homologue (Emily Ranty) in the *Direction Générale Déplacements* in the development of GHG-analysis criteria integrated into the statutory environmental evaluation.

Second, Nantes Métropole's external coordination occurs principally through the *Poles de proximité* (Mallet 10.12.07). The *Poles de Proximité,* or the decentralized offices of the C.U., is charged with working directly with the individual *communes*. These poles principally provide technical support and expertise in the development and implementation of actions (Mallet 10.12.08). The C.U. has an important role in providing the necessary technical support to *communes* and increasingly directly with individual citizens. Overseen by the centralized *Service Animation Développement Durable et Climat,* a number of different methods are used to engage partners, ranging from working directly with individual departments to quantify specific actions (see below) to the deployment of information services to engage the general public (*Allo Climat information hotline, ECOPOLE*).

4.2.3. Fostering Compliance with Rules and Developing a Shared Vision

The voluntary nature of the involvement of many actors in the PCET and GHG mitigation process can pose difficulties in assigning accountability for emissions. As such, the often-voluntary nature of the process has limited the development of formal, punitive sanctions for accountability. Instead of focusing on sanctions, which would have little place within a voluntary process, Grenoble Alpes Métropole has developed reputational incentives through the contracting process used to engage external partners within the PCET process. Both public and private actors that have signed the *Charte d'engagements* commit to reducing their emissions and, thus, develop actions to reduce their operational emissions. While voluntary, this formal engagement of actors within the process builds on the required action plan as well as a yearly follow-up and evaluation conducted by the *Agence Locale de l'Energie et du Climat (ALEc).* Violations, or non-compliance with emission reduction objectives, become a reputational risk that the partner must respect or face publicly. Further, the use of the ALEc structure by Grenoble Alpes Métropole as monitors has allowed for a partial de-politization of the process, as the *communes* perceive the ALEc as a neutral expert body rather than a potential political threat, as may be the case of the EPCI itself (Poimboeuf 10.10.21, Uhry 10.10.20).

Greenhouse gas emissions often do not independently lead to direct, resource-related conflicts among different users of the atmospheric sink (unlike other resources such as pasture, water, etc.), however conflict among actors can stem from the framing of the climate-change challenge as well as what options are perceived as being relevant and desirable to reduce emissions. While a simple plan of actions may have difficulties in overcoming these types of conflicts, the strength of the climate action plans lies in the creation of dynamic processes. The institutional processes set into place by the PCET bring together a wide range of actors (public, private, academic, experts) from different sectors to share information, discuss and set objectives, as well as identify appropriate and feasible actions for reducing GHG emissions. In doing so, these action plans are leveraging '*analytical deliberation*'[86] or structured and informed discussions that assist actors in reaching agreement on objectives and acceptable solutions. Analytic-deliberative processes create environments of exchange among actors (often through face-to-face contact and interaction), fostering both trust and learning. Both Grenoble Alpes Métropole and Nantes Métropole, as well as individual *communes* within the EPCIs, have put into place processes that capitalize on these types of exchanges. In Grenoble, the bi-annual *Forum Climat* for the PCET partners, as well as the European Energy Award process for internal services, fosters exchange (see Annex 6). Further, both Ville de Grenoble and Echirolles have developed initiatives with their internal services and the general population (Durand 10.10.22; Coindet 10.10.19). Nantes Métropole is equally deploying analytic-deliberative processes through the annual *Rendez-Vous Climat* of stakeholders and different thematic working-groups.

4.3. Information Tools and GHG Measurements: A Key Role for Governance

In both Grenoble Alpes and Nantes Métropoles, greenhouse gas inventories are important tools within the mitigation-coordination and governance process. As both Dietz et al. (2003, 2008) and Poteete et al. (2010) indicate, information has a role to play in any environmental-governance process (see Chapter 1). Greenhouse gas inventories typically are designed for a number of overlapping uses that while, in theory, should be conducted sequentially but rarely done so in practice (i.e. operational emissions, territorial emissions, organization-, territorial, or project-scale). Often, their initial purpose lies within the identification and planning of mitigation policies. This includes performing a diagnosis of existing emissions and identifying "baseline" emission trends. A diagnostic phase is typically followed by the development of emission-reduction scenarios to analyze the potential impact of different types of actors prioritized by cost, relevancy, or existing policy path dependencies. Once a set of GHG-mitigation actions are developed and implemented, inventory tools are needed as indicators of progress, tracking both the real impacts of individual actions as well as the overall "macro" progress at a given scale (whether that of a single actor or an entire territory). Inventories equally have an important role to play in communicating mitigation progress, whether for statutory or voluntary reporting among entities with the larger public or to promote discussion with partner actors.

[86] Well-structured dialogue involving scientists, resource users, and interested publics, and informed by the analysis of key information regarding environmental and human-environment systems, appears critical. Such analytic deliberation…provides improved information and the trust in it that is essential for information to be used effectively, builds social capital, allows for change and deals with inevitable conflicts well enough to produce consensus on governance rules. (Dietz et al. 2008 :616-617)

4.3.1. Towards a “Hierarchy” of Three GHG Information Tools?

As see in Table 41, an initial “hierarchy” or linked system of information tools has been developed by the two inter-communal structures. Both Grenoble Alpes and Nantes Métropole have deployed multiple inventory tools quantifying greenhouse gas emissions at a number of different levels (see Annex 6 for a more-detailed description of the different tools as well as and Chapter 6 for further analysis). Three general types of tools have been developed to date for use in the PCET process: macro, meso and micro approaches.

Macro territory-wide inventories have been developed by both EPCI to identify emission sources, develop a baseline for emission-reduction scenarios and other prospective studies and mitigation objectives, as well as track progress towards emission reduction of those targets. Grenoble Alpes Métropole has notably developed an annual inventory based principally on direct energy- and fuel-consumption data to track progress. While to date Nantes Métropole’s territorial emissions have not been tracked annually, the C.U. is currently developing a tool in partnership with *Air Pays de la Loire* to provide an annual snapshot of emissions.

The second category of greenhouse gas inventories tools focuses on the quantification of individual policy actions. Focusing more on identifying the order of magnitude of emission-reduction potential than precisely quantifying actual emissions, this tool has typically been paired with the identification of actions to be included in the climate action plans. In the case of Grenoble Alpes Métropole, the C.A. and the *Agence Locale d’Energie et climat* have developed rough annual inventories with the signatories of the *Charte d’engagement* for the PCET. The information allows the different actors, whether *communes* or private companies, to understand their emission sources, actions to take, and the steps necessary to achieve their often-ambitious emission reduction targets. Nantes Métropole has conducted a similar exercise internally through its quantification of policies and actions of the C.U. or *100 Actions* program. Part of a larger “rationalization” of policies and management, this program quantifies all actions and policies implemented by Nantes Métropole, which contribute towards meeting their GHG-mitigation commitments. Focusing to date only on those actions that reduce GHG emissions, the process aims to understand how different actions affect emissions, rather than construct a comprehensive, precise inventory. This quantification is co-constructed with the respective department or service to foster a better understanding of how actions affect GHG emissions. As such, the methodologies employed focus on capturing the order of magnitude of mitigation potential of an action, rather than quantify precisely the actual reduction.

Finally, each EPCI has equally developed a number of detailed, life-cycle analyses of greenhouse gas emissions. The principal objective of these micro-scale *Bilans Carbones®*, often using the ADEME’s methodology, is to understand how individual projects, policies, or service provisions influence greenhouse gas emission. Typically looking beyond direct emissions, these inventories include both upstream as well as downstream / end-of-life emission sources. To date, projects and public services, such as waste, water treatment, water provision and public spaces, have received the most attention. However, further studies, such as an analysis of the frequency of updating information technology (computers, etc.) and relative gains due to cradle-to-grave emissions, have been discussed (Gouriten 12.12.08). While more detailed than other types of inventories, the objective of the process, nevertheless, focuses on promoting comprehension rather than achieving an exact accounting of emissions. As such, issues, such as double counting, are often ignored, as the objective is to understand the impact of each set of proposed actions rather than all policies combined.

Table 41: Hierarchy of GHG information tools in Grenoble Alpes Métropole and Nantes Métropole

Inventory Types	Grenoble Alpes Métropole	Nantes Métropole
Macro: Territorial	- *Bilan energétique & GES Grenoble Alpes Métropole* (annual inventory)	- 1993 District GHG Inventory - 2006 *Communauté Urbaine* Inventory
Meso: Policy Actions & Scenarios	- *Plan Climat* Action Plans	- Quantification of policy actions (*100 Actions*)
Micro: Lifecycle analysis	- Inventory Services & Projects (Waste and water treatment)	- *Bilan Carbone® de Services Publics* (waste, water treatment, water provision, public spaces)

4.3.2. Methodological Differences and Considerations

Often the methodological choices made in terms of structuring a measurement tool are linked to its multiple uses. Different technical and methodological approaches are used in terms of the use of consumption-based data vs. statistical data, the emission scopes and scale of inventory perimeter and frequency. As such, the type of information produced can vary significantly depending on the different assumptions and hypotheses made. In the case studies, different tradeoffs in terms of level of detail (and thus cost in terms of both data and finance) as well as the scope of emissions included were encountered by EPCI. For those inventories to be used for diagnostic and tracking of emissions at the territory level, for both practical (data availability) and financial reasons (limited budget), a lifecycle approach was often discarded. For example, the need for an inventory methodology flexible enough to be deployed annually at the scale of the entire territory pushed Grenoble Alpes Métropole to develop their own methodology based on available data. Based on direct energy-consumption data and other existing sources, this methodology is less data intensive than the much more detailed *Bilan Carbone®* method principally available at the time (Filhol 10.10.18).

Second, the precision of quantification varied greatly among the different tools put into place by the EPCI. For local authorities, identifying the appropriate order of magnitude for calculating emissions from a source and/or the emission potential of an individual action was sufficient for the use required by the local authority. In the case of inventory tools quantifying the impacts of individual or groupings of policy actions, an emphasis was placed on the didactic and educational process rather than achieving a precise quantification of emissions. While in some cases precision is important, particularly when finances are involved and GHG reductions take the form of a fungible asset, in many instances, the real value added is the development of a general "carbon" culture. The use of smaller-scale inventories as learning tools to push for the wider integration of GHG mitigation into different policy sectors was noted in each case (Durand 10.10.22; Goubel 10.10.19; Gouriten 10.12.08). The methodological implications of different uses of inventories and the need for a certain level of coherence are further explored in Chapter 6.

4.3.3. Information Production and Appropriation

This development of a general culture around greenhouse gas mitigation appears linked not only to the existence of mitigation objectives and inventories, but equally the production process itself. As such, the idea of the co-construction of expert information with the full range of actors was often raised by interviewees. For a number of actors, the value of the GHG inventory within the GHG-mitigation process went beyond that of a "number," becoming, rather, a means of starting a dialogue among actor groups (Huré 10.12.08; Filhol 10.20.17). The development of a common "language" with which GHG mitigation efforts can be planned and discussed has helped many actors understand their role in achieving emission reduction objectives better (Buffiere 10.10.19; Filhol 10.10.19; Poilboeuf 10.10.21; Uhry 10.10.20). An important component of the appropriation has been the contextualization of the different measures to specific sectors through a continual dialogue: identifying the most appropriate unit of measurement and educating actors to what it specifically measures, as well as how it can be used to influence action (Huré 10.12.08). As such, it is important to look at the institutional arrangements that have been put into place to coordinate the production and use of expertise and information on greenhouse gas inventories (see Chapter 6).

Recognizing that long-term partnerships are necessary, EPCIs have begun to foster lasting relationships with a number of associations and non-governmental actors. In both cases, the EPCI have established important relationships with the local ASQA (ASCOPARG in Grenoble, *Air Pays de la Loire*) as well as a number of technical bodies at the regional level. These external partners typically play a key role in the provision of technical expertise, data and analysis needed to develop and maintain the different inventory tools. These relationships, as well as other questions related to the production of GHG information tools, are further explored in Chapter 6.

4.3.4. Limits and Future Developments

It is important to note that in both cases, greenhouse gas inventories and information tools face a number of limits. Lack of data, constraints on technical capacity, resources to work directly with partners, as well as ensuring the coherence of methodological approaches over time, continue to pose challenges. Further, there has been little linkage between greenhouse gas inventories and the potential for performance-based finance from national or other sources. Given the variety of methodological approaches used in France, fostering coherence and, potentially, the harmonization of approach not only within territories but also nationally (or internationally) may be necessary.

4.4. Section Conclusions: Governing Robustly?

When the robust environmental-governance framework as presented by Dietz et al. (2008) is used as a lens in the analysis of the climate action plans and institutional arrangements described above, it appears that much of what was predicted in the literature as necessary for common pool-resource management is found in the case of greenhouse gas mitigation. As seen above in Table 40, EPCI have implemented a range of policies that correspond to the requirements for robust environmental governance. Each EPCI has developed the programs and tools to provide the necessary information, often going beyond the provision of quantified greenhouse gas emissions to better contextualize mitigation actions for different actor groups. Different structures have been put into place to deal with conflict, often focusing on network-based approaches to foster dialogue among different services and groups as well as yearly meetings to bring the majority of actors together. Compliance with rules has been fostered through both voluntary contractual arrangements as well as monitoring and internal reporting. A variety of institutional models to foster coordination, dialogue and transversal action have equally been developed and implemented. Above all, it is apparent that, rather than just being a list of actions to reduce greenhouse gas emissions, climate action plans are a process to engage, educate and federate a large range of actors with different levels of capacity as well as different priorities in order to achieve often-ambitious emission-reduction objectives.

Nevertheless, the case studies of Nantes Métropole and Grenoble Alpes Métropole have both demonstrated that the managers of GHG mitigation in these two municipalities continue to struggle with fostering wider behavioral change. In both cases, behavioral change has been identified as a key means of facilitating GHG-emission reductions, both among the employees and services of the governing institution itself, but also among the other government institutions, private companies and citizens within the urban area. However, there is equally a continued recognition that further development is needed in terms of policy, interaction and governance strategies to do so. While in both instances the municipalities have attempted to provide the tools to facilitate change (Durand 10.10.22), there is recognition that more must be done. These changes include issued of policy-attention span (Guillard 10.12.08), assisting in the learning of new habits (Gouriten 10.12.08) as well as larger systemic changes that go against what has often been framed as a larger, macro-consumerist nature in general (Grange 10.03.02) along with accepting the changes that are frequently viewed as constraints that GHG-emission reduction may induce (Poimboeuf 10.03.01). Influencing behavioral change may require going beyond the macro-level coordination of actions at the scale of the inter-communal structure to the integration or mainstreaming of GHG-mitigation concerns into meso- and micro-scale sectoral (transport urbanism, etc.) decision-making processes.

5. SECTORAL INTEGRATION: TRANSPORT FRAMING AND GHG MITIGATION

While climate action plans appear to be establishing the institutional foundations to improve coordination for GHG mitigation, it is also important to understand what impact this is having on sectoral decision making. In the cases of Grenoble Alpes and Nantes Métropole, the framing of transport as a policy issue has increasingly incorporated climate change as an integral element since the mid-2000s. This appears to have had an impact on the framing of passenger-transport policy, resulting in increased attention to the general strategy, objectives and policy priorities in the *Plan de déplacements urbains* (PDU). A number factors have potentially led to this increasing "mainstreaming", including the increased visibility of climate change as an important policy subject at the national, European, and international levels. Nevertheless, in both the cases analyzed below, the climate action plans (PCETs) have been specifically identified in documents as leading to its integration. This section analyses the impact of the PCET on the PDUs in Grenoble Alpes and Nantes Métropole. It is important to note that while the PCET has influenced the framing of transport-related subjects, there appears to be little deviation from existing trends in terms of the concrete actions approved and implemented.

5.1. Nantes Métropole: the 2010-2015 PDU

A significant transition can be noted between the development of the 2000-2010 PDU and the 2010-2015 PDU currently in the final stages of the approval process. In the 2000-2010 PDU, no mention of GHG mitigation or larger climate-change issues occurred. Rather, specific attention was given to the priorities established by the 1996 *Loi sur l'air et l'utilisation rationnelle de l'énergie* (*LAURE*), which in many cases are policies liable to reduce to greenhouse gas emission (see Chapter 3).[87] While the *LAURE* legislation specifically targets energy use, there was little direct discussion of energy-efficiency issues in the PDU documentation. Rather, objects were framed in terms of developing transport alternatives to the personal-vehicle use[88] as well as managing mobility and transport demand in general.[89]

Within the 2010-2015 PDU currently in the final stages of approval, when research was conducted, climate change and greenhouse gas-emission mitigation takes a more principal position within the framing of the larger PDU document. Instead of referring to national legislation, actions associated with GHG mitigation are couched within the larger framework of Nantes Métropole's PCET. For example, within the prerequisite diagnostic of the territory, GHG emissions are framed as an issue of concern, recognizing transports as a principal source of GHG emissions (29%) and of energy consumption (22%). Further, the relative importance of GHG mitigation can be seen within the environmental evaluation and its position before all other pollution issues, including air quality and noise pollution. Further, Nantes Métropole's 2010-2015 PDU strategy and action groups link greenhouse gas emissions and climate change with issues of livability and quality of life.

The PDU sets quantified GHG-emission-reduction objectives at the 2030 horizon, aiming to reduce the emissions stemming from transports from an estimated 750 kton CO_2e / year to 580. The PDU frames urbanism and transport in a way that is synergistic to reducing GHG emissions, but is not necessarily related to climate change. While it is not clear how this objective of reducing emission by 20% was established, given that no quantified action plan has been included, the larger PDU as a whole is framed as a means of emission reductions. Transport policy is expected to reinforce the link between transports and urban development, which are recognized as being important for economic growth (competitiveness of the territory), while at the same time addressing the concerns of air pollution, GHGs, noise, and

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[87] Distribution of the *voirie* (roadspace) to give priority to less-polluting modes; modification of a network to be less radial with more connections in the periphery; improve the multi-modal offer; parking.
[88] For instance, increase the public-transport supply (extension of tramway lines 2 and 3, creation of line 4 Busway, thus resulting in an increase of +22 % in kilometres offered and +36 % in frequency of passage during the PDU period), policies to support soft modes (bike services, bike pathways etc.), park-and-ride facilities (5,800 places in 39 parking facilities in May 2010), support for car-sharing and carpooling.
[89] For instance, encourage the development of company mobility plans (*plans de mobilité d'entreprises*).

other negative externalities. Urbanism is principally framed in terms of creating the "city of proximity" (*ville de courtes distances*), thus reducing the overall demand for mobility. Finally, GHG mitigation has been introduced into the formal evaluation of the PDU. The 2000-2010 PDU calls for the creation of an air-quality observatory linked to the evaluation of the PDU. Within the 2010-2015 documents, the quantification of CO_2 emissions from local transport is added as an indicator for evaluation, although no specific objective in terms of a fixed objective is given.

5.2. Grenoble Alpes Métropole: the 2007-2012 PDU

The 2007-2012 PDU of Grenoble-Alpes Métropole also introduced greenhouse gas mitigation as a principal objective of the larger urban passenger-transport strategy. Similar to the cases of Nantes Métropole, specific reference to the *communauté d'agglomération's* climate action plan is made within the physical document to justify mitigation objectives. The PDU adopts the larger objective of Grenoble Alpes Métropole's PCET to stabilize total emissions across the territory at 682,000 tons CO_2e per year and energy consumption at 219,000 TEP[90]. To achieve this objective, the PDU cites the need to stabilize and, if possible, reduce car traffic between 2002 and 2012. To do so, the C.A. has prioritized the expansion of the public-transport network, different policies to improve multi-modal trips (park-and-ride, network coordination, real-time information) as well as using parking policy as a means of incentivizing other modes (SMTC 2007). Within the accompanying environmental evaluation, greenhouse gas mitigation is grouped with the other pollutants resulting from local transport. However, while given prominence, higher priority appears to be given to the issue of local air pollution, a reoccurring problem with the agglomeration that exceeds EU concentrations limits multiple times per year. Greenhouse gas-mitigation actions have equally been folded into the PDU Observatory: this includes tracking both transport-related energy use and GHG-emission data for the 26 communes among other indicators, including the integration of low-emission and electric vehicles into the territory-wide fleet as well as tracking modal changes.

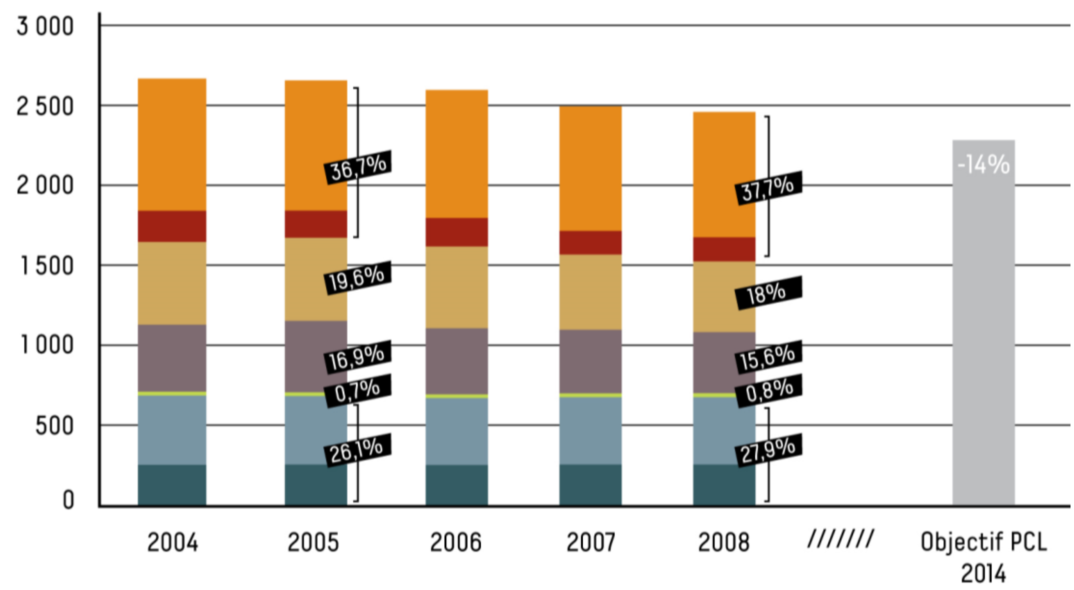
5.3. An Evolution in Framing, but What Real Change in Emissions and Sectoral Decision-Making?

Evaluating the impact of the climate action plans on GHG emissions in general is a complicated process, given that a number of socio-economic factors as well as climatic conditions (average seasonal temperature) can significantly affect emission levels. This is compounded in the transport sector where data used in calculating emissions is based on modeled rather than direct consumption data. In Nantes Métropole, as there has not be an inventory of GHG emissions conducted since the territory-wide study in the mid-2000s, it is not possible to assess the change in GHG emissions due to policies from the climate action plan. However, in Grenoble Alpes Métropole, as seen in Figure 17, GHG emissions have been reduced by 7.4% corresponding to a 5.4% reduction in energy consumption between 2004 and

[90] Tons equivalent petrol

2008. While actions appear to have stabilized transport-related GHG emissions, the majority of reductions appear to stem from the residential sector. This stabilization of transport appears to be confirmed by the results of the 2010 survey of household transport habits (*l'Enquête Ménages-Déplacements*). The total number of daily trips within the perimeter of study decreased by 1% (2.75 million) between 2002 and 2010, even though the total population has increased by 6% (757,000 people) within the perimeter of study, and the number of daily trips per person has decreased by 7% (3.6 trips per person).[91] Nevertheless, it is difficult to discern what part of stabilization is due to the PCET and what exists from existing transport policies and trends.

Figure 17: Evolution of GHG Emissions in Grenoble Alpes Métropole 2004-2008 (k.t. CO_2eq.)



	Commercial transport		Agriculture		Residential		Small Industry
	Passenger transport		Service Sector				Industry in EU Emission Trading System

Source: After La Métro 2009

Nevertheless, as seen in the above section and summarized in Table 42 climate change and greenhouse gas mitigation have been incorporated into the larger framing of planning documents in Nantes and Grenoble-Alpes Métropole. Greenhouse gas mitigation is increasingly prioritized among the most important issues to be addressed by the PDU and the larger transport strategy in general. However, as interviewees note, is this inclusion just another policy "fad", as some interviewees noted, such as the rise of noise pollution and other subjects in the past (Herbreteau 10.12)? The majority of actors interviewed stressed that historical trends, rather than the introduction of new priorities from the PCET process, have led to the relative stabilization of emissions from this sector (Gouriten 10.12.08; Filhol 10.10.18; Mallet 10.12.07; Ranty 10.12.07; Huré 10.12.07). While it appears that GHG mitigation gives added weight to and is coherent with existing transport-policy strategies and

[91] It is important to note that the perimeter of study is much larger than Grenoble Alpes Métropole, covering the larger metropolitan area.

trends, it is unclear as to how the inclusion is being formalized as a permanent part of the decision-making process. Thus, it appears equally important to understand how GHG mitigation is being incorporated into the expertise used in developing and evaluating both planning documents and individual project actions (see Chapter 5 for further analysis).

Table 42: Inclusion of GHG Mitigation in PDU Framing

PDU Components	Nantes Métropole	Grenoble-Alpes Métropole
Diagnostic	- Reference to territorial GHG inventory	- Reference to territorial GHG inventory, detailed study to disaggregate by *commune*
Motivation	- Reference to the climate action plan	- Reference and adoption of PCET objectives
Environmental Evaluation	- Quantified analysis of scenarios ; qualitative analysis of actions	- Quantified analysis of scenarios
Evaluation	- GHG indicator integrated into the observatory	- GHG indicator integrated into the observatory

Source: author

6. CONCLUSIONS: EVOLUTIONS AND PROGRESS TOWARDS POLYCENTRISM, BUT SECTORAL MAINSTREAMING NEEDED

As seen in the above sections, the evolution of modern climate and energy policy in the 1970s in France was shaped by EU regulations and national actions but equally by the evolving distribution of competencies across levels of governance in France. The translation of emission-reduction and energy-use objectives by the French Government and the development in 2000 and 2004 of structured national plans and programs to address greenhouse gas emissions have demonstrated recognition of the issue at the national level. Further reinforced in 2005 by the adoption of the *Facteur 4* 2050 GHG-emission-reduction objectives, GHG mitigation has become a policy priority, although much work continues in defining how this will be achieved. Within this context, the institutional context for addressing climate change and greenhouse gas mitigation remains complex and highly dependent on existing institutional forms. Administrative, policy and framing fragmentation, combined with capacity limitations within the multi–level governance context for climate change, present a number of barriers towards implementing GHG-mitigation policies. There appears to be a clear need for coordination both across and among levels of governments, sectors, etc. to foster the collective action necessary to reduce greenhouse gas emissions. This section will end with recommendations addressing these issues.

6.1. An Evolving Process Overcoming Multiple Institutional Limits…

Applying the typology developed by Cyria Emelianoff (2010) concerning local *Agenda 21*s (see Table 38) to the cases of Grenoble Alpes Métropole and Nantes Métropole suggests that the evolution of approach noted with the *Agenda 21*s is also applicable to the evolution seen with climate action plans. As Emelianoff's framework suggests, Stage 1 efforts, focusing principally on communication and outreach, have begun to pay off in both Nantes and Grenoble. In the case of Grenoble, the *Agence Locale de l'Energie* (ALEc) has noted that the actors are now coming to them to participate in the PCET, instead of the ALEc going and searching them out (Goubel 10.10.19). A common culture concerning greenhouse gas emissions, as well as different forms of emulation in terms of mitigation actions and priorities, has equally begun to develop among the partners, organizations and entities (Goubel 10.10.19).

Further, what can be seen as a transition from the first to the second stage is also clear in both cases. During the first and the beginning of the second stage, the types of actions found within and linked to the climate action plan are based principally on a 'reuse' or re-classification of existing actions and policies. Epitomized by Nantes Métropole's *100 Actions* focusing on mobilizing existing public policies and quantifying their potential for GHG mitigation, this "reuse" appears to be an important step in identifying and taking stock of how existing actions impact emissions. More recently, actors in Grenoble Alpes Métropole have begun to notice a shift towards the development and implementation of new actions focusing on greenhouse gas emissions that has accompanied a new framing and prioritization of GHG mitigation (Filhol 10.10.18; Poimboeuf 10.10.21). This is an important step as all actors have indicated that a departure from business-as-usual practices will be necessary to achieve the ambitious emission-reduction targets that both Grenoble and Nantes have set for themselves.

The strength of the climate action plans for both Grenoble Alpes and Nantes Métropole appears to lie in the development of dynamic participation-based processes. Rather than a laundry list of mitigation actions, local authorities are working with a wide range of actors to foster dialogue and learning as well as mitigation action. While often taking different institutional approaches and different policy mechanisms, they have been able to overcome the different barriers linked to the complex multi–level governance context. As seen in Table 43, both EPCIs have put their climate action plan into place at the scale of the entire inter-communal structure, led principally by the central authority. They have engaged both member communes as well other local actors – either through a system of contractual pledges in the case of Grenoble or through the existing network of '*referants climat'* or through Nante's *pôles de proximité*. These actions, combined with other coordination mechanisms have allowed the EPCI's to move towards overcoming identified administrative and jurisdictional fragmentation. Further, these different coordination mechanisms often focus on fostering exchanges and learning among actors, hold the potential towards achieving convergence in terms of framing the climate-change problem and the definition of shared objectives.

Grenoble Alpes Métropole and Nantes Métropole have also taken significant steps towards addressing limitations on information and expertise to foster coordination and collective action. Often developing long-term partnerships with expert organizations and associations, the two EPCIs have attempted to develop the internal capacity necessary to produce as well as incorporate the information for governing GHG mitigation. Adopting a process-oriented approach, both EPCIs have followed similar paths in establishing scientific councils to leverage scientific expertise in terms of the entire process. Further as seen above, each EPCI has developed the programs and tools to provide necessary information, often going beyond the simple provision of quantified greenhouse gas emissions to better contextualize mitigation actions for different actor groups. Different structures have been put into place to deal with conflict and accountability, often focusing on network-based approaches to foster dialogue among different services and actor groups, as well as yearly meetings to bring all actors together. Compliance with rules has been fostered through voluntary contractual arrangements as well as monitoring and internal reporting. A variety of institutional models to foster coordination, dialogue and transversal action have equally been developed and implemented.

Table 43: PCET Solutions to Gaps on the Ability of Local Authorities to Reduce GHG Emissions

	Grenoble Alpes Métropole	**Nantes Métropole**
Governing a Fragmented Context		
Administrative Fragmentation	PCET led at the scale of the EPCI, coherent with the majority of planning documents	
Fragmented Jurisdictions *Fragmented Objectives*	- Targeting of partner organizations to federate them into the larger, dynamic process (*communes* and the private sector) - Internal coordination: European Energy Award, *Plan d'Actions Transversal*; - External coordination: *Charte d'engagements*; annual reporting and action plans	- *Agenda 21* network (*referants climat)* - Internal coordination: Mobilization of public policies; Seminars - External coordination*: Pôles de proximité* ; thematic groups
Fragmented Funding	- *Tableau de bord*	
Information and Expertise for Collective Action		
Capacity Limits	- Scientific council - Partnerships with related organizations (AURG, ASCOPARG) - *Tableau de bord* - European Energy Award - *Agence Locale d'Energie et du climat*	- Scientific council - Development of internal capacity (GHG quantification) - Mobilization of public policies - *Pôles de proximité* / existing structures – *EcoPole, Espaces Info Energie, Allo Climat*
Information Limits	- Hierarchy of GHG information tools (territory, policies & strategies, project lifecycles) - Development of internal GHG-quantification capacity - Partnerships with technical bodies: *ASQAs, urban planning agencies*, others	
Accountability	- *Charte d'engagement* + individual action plans	- Mobilization of public policies (*100 Actions*)

6.2. …but with Llimited Mainstreaming into Sectoral Policy Streams

While it appears that, in the two cases, climate action plans have ventured into Stage 2 of their development, the larger question remains of what is necessary to pass to Stage 3. Stage 3 involves the general and widespread integration or "mainstreaming" of consideration for GHG emissions into policy making across sectors. To date, there appears to be a base for mainstreaming in the existing development of a culture of benchmarks and indicators to track progress towards quantified emission reduction objectives. Further, the development of accountability actions, such as the quantification and evaluation of partner action plans by the ALEc in Grenoble, has spread a general "carbon" culture. This is having an impact on how both administrative staff and elected officials in the *communes* are thinking about the issue

(Filhol 10.10.18). However mainstreaming appears to require a more-comprehensive integration of consideration for GHG emissions into individuals' decision-making processes.

Achieving reductions in the transport sector illustrates the difficulties that can be found in doing so. As shown in Chapter 3, achieving GHG-emission reductions requires changes in the PDU, which outlines the larger transport strategy for the *agglomeration*, as well as changes in the accompanying urban-planning documents. While the climate action plans of Grenoble Alpes Métropole and Nantes Métropole are able to include ambitious transport policies that contribute to the reduction of GHG emissions in the transport sector, this does not represent the climate action plan has or will have an impact on how transport policy is formulated. Rather the PDU in vigor, which tend to predate the development of climate action plans, responds to earlier requirements linked to energy-efficiency policies from the 80s and 90s (see Chapter 3). While synergies exist, in terms of shared policy objectives of fostering a modal shift and reducing urban sprawl, climate action plans are limited in how to influence the trajectory of transport and urban policy further. The majority of actors interviewed stressed that historical trends, rather than the introduction of new priorities from the PCET process, have led to the relative stabilization of emissions from this sector (Gouriten 10.12.08; Filhol 10.10.18; Mallet 10.12.07; Ranty 10.12.08; Huré 10.12.07). Rather, PCET and GHG mitigation have served to give added weight and validity to actions that typically foster the reduction of emissions already.

Achieving the ambitious *Facteur 4* greenhouse gas-emission-reduction objective requires the generalization of a logic to understand how a wider range of policies impact greenhouse gas emissions. In many cases, this requires an introduction of the emission-reduction logic into all policy streams. Rather than the PCETs, sectoral planning documents (such as the PDU, PLU and SCOT) currently appear to dictate how concern for climate change is integrated into transport and urbanism policies. As such, it appears necessary to understand how the development processes around these documents are currently taking greenhouse gas-mitigation criteria into consideration (Mallet 10.2.09). Taking GHG mitigation in the context of existing strategies requires going beyond treating only concerns for energy use and establishing linkages with larger questions of social and economic sustainability as well as other environmental benefits from policy actions. Chapter 5 focuses on this integration or mainstreaming.

6.3. Recommendations: Institutional and Procedural Changes

Grenoble Alpes and Nantes Métropoles have made significant progress to overcome the barriers to the coordination and fostering of the collective action necessary to reduce greenhouse gas emissions. Nevertheless, a number of challenges remain to achieving the polycentric governance needed to foster the centralized coordination of decentralized action. The polycentric governance of greenhouse gas mitigation appears to require that centralized coordination of actions at the scale of the inter-communal structures foster decentralized action among the multiple actor groups (*communes*, private companies, service providers, and individual citizens). Further, the "resources" for governance, including capacity, information and finance, are key for a long-term dynamic didactic process to foster the development and appropriation of a shared "culture of climate" and objectives.

As seen in Table 44, a number of strategic orientations, policy strategies and actions appear necessary at both the national and inter-communal levels to further the polycentric governance of greenhouse gas mitigation. Both national and sub-national actors must continue to work to identify and establish the most pertinent perimeter for action. This includes putting into place means of facilitating cooperation across existing institutional perimeters. The State equally needs to continue to remove and avoid regulations that reduce the capacity of local actors to reduce emissions, although is typically more sector specific. The largest role for the State is assisting sub-national actors in obtaining the necessary financing. As noted above, sector-specific (transport, residential energy efficiency, urban planning) financing is increasingly available for projects. Nevertheless, the integration of GHG criteria into these individual financing decisions appears necessary. Further, resources to support the larger dynamic climate-plan process remain limited. Local governments are still struggling to secure the resources necessary not only to implement greenhouse gas-mitigation efforts, but equally to accompany the larger dialogue, learning and appropriation process with the range of necessary actors. Financial resources should also be paired with technical support resources to assist in overcoming continued capacity and information barriers.

A number of orientations and strategies, as well as specific actions for the two cases studies here, can be identified for inter-communal structures, which should continue to develop the dynamic, didactic, process necessary to coordinate the increasingly decentralized transversal actions necessary for GHG mitigation. This need for coordination will likely increase as GHG mitigation is integrated into sectoral decision-making and policy flows. The above analysis indicates that inter-communal structures have an important role to play to provide technical assistance to actors. This requires the development of an internal capacity to treat the subject, when possible, as well as long-term partnerships with local technical bodies (see Chapter 6). Further, the development of information and a range of GHG-measurement tools necessary to govern GHG mitigation appears key. Contextualized GHG inventories are important not only as management but also as didactic tools to foster dialogue, learning and appropriation of the subject. Nevertheless, the proliferation of so many tools treating different elements of a similar problem with varied technical approaches and assumptions poses important questions in terms of the harmonization of methodologies.

It equally appears that the two inter-communal structure studies can equally offer each other a number of lessons. While Grenoble Alpes Métropole has worked with its various partners to establish GHG-mitigation actions, the *100 Actions* quantification process launched by Nantes Métropole could be a further means of using rough inventories to aid all departments and services in understanding the impact of their actions on emission. In return, the *Charte d'engagements* model deployed by Grenoble Alpes Métropole offers Nantes Métropole a number of lessons in engaging and federating a variety of actor groups into the process. Further, Nantes Métropole must continue its efforts to develop an annual inventory for tracking emissions both internally as well at the scale of the territory.

At all levels, an important next step in achieving France's ambitious emission-reduction targets will be the continued integration or "mainstreaming" of mitigation into sectoral decision making and financing issues. Both of the inter-communal structures studied above have begun to experiment with tools to integrate GHG mitigation into various planning documents. This appears to be an essential process to widen the scope of climate action to achieve the ambitious *Facteur 4* greenhouse gas-emission-reduction objectives. Mainstreaming requires going beyond the quantification of the policies already in place, which has often been the case to date to generalize a GHG logic into upstream decision-making. As such, the following chapter analyses the integration to date of greenhouse gas mitigation concerns into the *Plan de déplacements urbains* decision-making process.

Table 44 : Recommended Strategic Orientations, General Policy Strategies and Needed Modifications for Polycentric Governance of GHG Mitigation

	Strategic Orientations	General Policy Strategies	Specific Modifications Needed
French Central State	Foster: - Reduce barriers to local–scale GHG mitigation (regulations, limits) - Institutional arrangements facilitating coordination Provision: - Technical assistance - Mandate for action - Financial framework	Mandate: - National GHG structure and the recognized role for local action Institutional Framework: - Foster collaboration / joint action among territories Finance: - Support both individual actions and staff and technical needs of larger climate action-plan dynamic - Domestic offset project framework - Fiscal policy (taxes) - Subsidies, grants, loans and transfers (*dotation*) Technical: - GHG methodological guidelines - Technical partnership - Access to data	- Funding for diagnostic studies - Resources for development and implementation (staff, expertise) - GHG-mitigation criteria integrated into sectoral financing mechanisms (i.e. climate criteria in transport-project funding) - Framework for domestic offset projects (*completed*) - Performance-based subsidy or financing (project in development by Nantes Métropole and other partners)
Inter-communal Structure	Foster: - Process-based on dialogue and learning for GHG mitigation - Coordination at the scale of the inter-communal structure of decentralized mitigation actions Provision: - Technical assistance (from data to action) - Long-term information and learning to foster appropriation	Process-based dialogue - Federate actor groups - Internal and external coordination with actor groups with engagement (accountability) Information and learning - Develop multiple types of inventory tools contextualized to the needs of actors - Development of GHG inventories as a didactic tool	Grenoble Alpes Métropole - Quantification of internal policy actions (i.e. Nantes' *100 Actions* approach) that increase and reduce emissions - Engagement with wider public & citizens (*in development*) Nantes Métropole - Engagement of partners – contractual model from Grenoble - Develop annual GHG inventory (*in development*) - Expand *100 Actions* to analyze actions that increase emissions to foster changes Both: - Integration or "mainstreaming" of GHG mitigation into sectoral policy making

SECTION 3
MEASURING FOR MITIGATION:
INFORMATION TOOLS, GREENHOUSE GAS EMISSIONS AND URBAN PASSENGER TRANSPORT IN FRANCE

CHAPTER 5
INTEGRATING THE PUBLIC AND THE ENVIRONMENT IN DECISION MAKING: IMPLICATIONS FOR LOCAL TRANSPORT PLANNING IN FRANCE

1. INTRODUCTION

The development of policy tools and coordination mechanisms such as climate action plans can play an important role in the long-term reduction of greenhouse gas emissions. These documents tend to set a larger dynamic process in place to develop and diffuse a culture of “carbon” among actors. Nevertheless, these plans have been less successful in influencing the sectoral decision-making process and the selection of individual policies. When policy objectives between climate and sectoral policy are similar, synergies can be exploited, leading to increase emission reductions. In the case of urban passenger transport, as seen in Chapter 4, in the two cases studied the climate action plans developed adopted the policies and actions already prescribed by the separate processes. However, the continued increase of GHG emissions in the transport sector in France suggests that more systemic integration of GHG emission reduction is necessary to achieve the *Facteur 4* mitigation objectives. As such, it appears equally necessary to analyze how the integration or “mainstream” greenhouse gas mitigation into individual sectoral decision-making processes occurs.

As seen in previous chapters, within the urban passenger transport sector in France, recognition of the importance of climate change has increasingly made GHG mitigation part of how transport policy is framed as a policy subject. Whether stemming from binding regulatory changes, optional guidelines or voluntary actions, the inclusion of GHG mitigation as a recognized, and often quantified, indicator across the different stages of a transport project and/or policy’s “life” has been seen over the last five years in France. However, it is important to understand how this “mainstreaming” is occurring within the existing decision-making context. GHG mitigation is the most recent of a number of environmental preoccupations which themselves are, equally, just one category among a number of competing priorities. As such, it appears that mainstreaming of GHG mitigation is influenced by two interrelated issues. First, mainstreaming can be affected by procedural issues. Existing difficulties in terms of how the public inquiry and environmental evaluation of planning documents and projects are performed in the urban passenger transport planning process in France influence the uptake and treatment of different issues. Second, beyond procedural issues, the technical and didactic qualities of the information or expertise used to integrate GHG mitigation can influence its appropriation by decision-makers.

This chapter explores the inclusion of greenhouse gas mitigation as a policy concern in urban passenger transport in Nantes Métropole and Grenoble Alpes Métropole. To do so, the analysis focuses on the development of the *Plan de déplacements urbains*, the principal document used in the local-scale transport planning process as well as the inclusion of GHG criteria within the analysis of individual transport projects. The analysis adopts the analytical framework established by Cash et al. (2003) looking at the credibility, legitimacy and saliency of expertise for the decision-making described in Chapter 1. These two cases not only confirm many of the critiques identified elsewhere, but also present a number of interesting examples of what information may be useful to inform a decision-making process struggling not only with GHG mitigation, but also a wide range of social, economic and environmental priorities.

1.1. *A Framework for Analyzing Information for Decision-Making*

As elaborated in Chapter 1, a robust theoretical framework exists for understanding the governance requirements for fostering collective action around environmental subjects. The work of Poteete et al. (2010) and Dietz et al. (2008) builds on the larger work of Elinor Ostrom (2000, 2009) in understanding what micro-scale contextual elements and institutionalized governance functions and principles can lead to the sustainable management of the environment. This chapter looks principally at what Dietz et al. term as *"Involvement of interested parties in informed discussion of rules (analytic –deliberative processes)*" and the "*Provision of necessary information*" (2008).

First, Dietz et al. (2008) note the importance of the *inclusion of analytical-deliberative processes*, or those that allow for iterative discussion and learning among the different actors involved around a policy subject. This builds on the idea that collective action is dependent on reciprocity and trust between actors (Poteete et al. 2010) built though iterative contact and discussion. Through these processes, learning can occur that leads to the development of a common framing of a policy issue among actors and the development of a wide range of strategic options, policy actions and tools that are considered effective and, above all, suitable by those involved. Actors are able to learn from information, leading to an evolution of the ideas that structure and frame a given issue (Hall 1993:289). Further, how issues are framed will influence what solutions are proposed to solve them, how different actors engage on the issue and what scarce resources are made available (Kingdon 2002). As seen in Chapter 3 in the case of transport and urban planning, while some values and frames may change, this can be a slow process. Kingdon stresses that "Old categories and old means of classifying subjects into those categories tend to persist" (2002:112). As such, iterative learning processes can be essential to the acceptance of a given plan or project when a broad range of actors, each brining their own categories and classification of subjects, is involved.

Second, the provision of the "*necessary information"* for policy making on a complex environmental subject is also key. The inclusion or mainstreaming of greenhouse gas mitigation into the urban transport policy decision–making process requires information that communicates the impact of actions and policies on GHG emissions. Applying the theories of Cash et al. (2003), concerning the legitimacy, credibility and saliency of the information and expertise integrated into policymaking processes, allows for an analysis of the role of different forms of expertise within the process. Cash et al. posit that the perceptions of saliency, the credibility and the legitimacy of the information by stakeholders can influence the decision-making process and outcomes. As presented in Chapter 1, the credibility of information refers to the scientific adequacy of information or expertise. Perceptions of legitimacy reflect the inclusion of different perspectives of the involved stakeholders that were considered and that the resulting expertise is not biased. Finally, and perhaps most important for the following analysis, the saliency of information relates to the relevance of the information to the needs of decision-makers given institutional processes as well as competing or related policy priorities. This suggests that the value of the information for decision making is not only in its technical exactness, but equally influenced by how the information is produced and how it enters into the policy making process (timing, format, etc.).

1.2. …within an Increasingly Decentralized Decision-Making Context in France

As seen in Chapter 3, the French legal context distributes the competencies for different aspects of transport planning across the different levels of government (State, *région*, *département*, *EPCI*[92], *commune*), with the central government typically responsible for establishing rules and regulations and providing limited financial subsidies through calls for projects, etc. While the national government and the respective ministries remain active in both establishing larger-scale priorities as well as laying out the basic path that decision-making processes must follow, much of the specific financial–as well as strategic and technical decisions–are made by local authorities.[93] Much of the independence of local actors in terms of urban passenger transport planning and implementation stems from their relative financial independence through the "*versement transports*,"[94] a tax levied on businesses to finance transport projects and which is paid directly to local authorities for the development and operation of public transport (Quinet 2000, 2010).

Coordinating and achieving collective action in the transport sector can be challenging as the number and type of actors involved in the transport sector is highly diverse. As noted by Jouve in his 2002 study of the *Plan de déplacement urbains* of Grand Lyon, over 15 different professions and types of actors can be involved in the development of plans and projects. Further, each brings a set of framing of the subject in terms of operating procedures, priorities, measures of success and acceptable options and solutions to the table for discussion. As such, a complex context exists to create the collective action necessary to coordinate and integrate environmental issues into the decision–making process.

Additionally, the governance of transport has seen a number of changes that has further increased the range of actors involved, along with the issues considered in decision making. In addition to the decentralization of local and regional transport decision making,

[92] *Etablissement public de coopération intercommunale*

[93] However, it should be noted that both planning documents as well as major projects subject to environmental evaluation and requiring a "*declaration d'utlité publique*" must undergo a review by the *préfets de département*, the representative of the State at the local level. This review process, however, does not judge the value of the project itself, but, rather, serves to assure that the prescribed methodologies and procedures in terms of public participation as well as formal evaluation are correctly followed.

[94] By far the largest source of financing for both transport operations as well as investment comes from the *versement transports*, a tax paid by local businesses with more than nine employees based on total payroll in urban areas with over 10,000 residents. The central State sets the maximum tax rate with local authorities able to set the rate applied within their jurisdiction (see Chapter 3 for more information).

there has been an evolution in terms of public participation and consultation. In addition, the last three decades have seen the increasing integration of environmental analysis into the policy making process through a system of environmental impact studies for construction and development (*aménagement*) projects, dating from the 1970s, as well as the statutory environmental evaluation (*évaluation environnementale*) of planning and strategy documents.

1.3. Multiply Planning Documents and Decision-Making Processes

Analyzing the integration of environmental criteria (including greenhouse gas mitigation) into transport policymaking spans multiple decision-making processes at multiple levels of government. As seen in Chapter 3, the different planning documents framing transport and urban planning in France address different scales as well as different policy competencies. Each of three levels–macro, meso and micro–offer different opportunities to reduce GHG emissions. At the *macro* level, or that of the SCOT, decisions are made concerning the settlement patterns across the greater urban area. As seen in Chapter 2, the localization of activities can greatly influence the demand for mobility and, thus, the total distance travelled. Integration or mainstreaming is equally important at the *meso* level, or that of the individual planning documents including the PDU or those documents related to urban planning, such as the *Plan local d'urbanisme* (PLU) or the *Programme locale d'habitat* (PLH). These documents translate both sectoral objectives as well as the over-arching development strategies outlined in the SCOT into a specific administrative jurisdiction. At this level, choices are made concerning the distribution of activities within a smaller perimeter (PLU, PLH), as well as how this distribution can be best served by both public and private transport options (PDU).

Finally, at the *micro* scale, or that of an individual *commune* or project, the integration of GHG mitigation may, in many ways, be more limited. Once an individual project, whether a public transport line or the redevelopment of a neighborhood, has been approved at the *meso-scale*, the choices in terms of reducing emissions from the transport sector are most likely marginal. While specific decisions concerning technologies, materials, path, etc., can influence a project's emissions, it is much more difficult to reduce systemic, large-scale emission sources at the scale of the SCOT (i.e. demand for mobility).

As key choices concerning actions directly related to or synergistic with GHG mitigation are made within each of these decision-making processes, it appears that the mainstreaming of GHG criteria into each one is necessary (see Table 45). However, it is also important to assess the enforceability and impact of each planning document and process. For example, while the potential for the SCOT to influence the distribution of activities across the territory is potentially high, the implementation of this strategic planning document does not fall to a single administrative entity. As such, its implementation may be limited by the need to be translated by individual authorities within the SCOT–planning perimeter. Thus, the translation of policies and strategies synergistic with GHG mitigation may not be ensured, particularly when they may infringe on the economic development (location of employment, housing, services) of individual EPCI or *communes*. Conversely, in the case of the PDU and PLU, while this document does correspond to a specific enforceable jurisdiction, it is less able to treat many of the macro-scale questions. As such, while integration across decision-making processes appears necessary, the trade-off between the potential to influence often difficultly-enforceable strategic orientations and concrete actions must be taken into consideration.

Table 45: Distribution of Planning Competencies across Scales

Sectoral Implications			
Scale	**Macro–Systemic**	**Meso**	**Micro**
	Greater urban area	**EPCI jurisdiction**	**Individual communes**
Urbanism	- *Schéma de cohérence territorial* (SCOT)	- *Schéma de secteur* - *Plan Local d'urbanisme* - *Programme locale d'habitation*	- *Plan local d'urbanisme* - *Autorisation de constuire*
	- Distribution of activities across the metropolitan area (employment, residential, services)	- Distribution of activities within EPCI - Residential vs. business districts	- Location with *communes* - Mixed-use areas - Density along public transport lines
Transport	- *Schéma de cohérence territorial* (SCOT)	- *Plan de déplacements urbains* (PDU)	- *Plan de déplacements urbains* (PDU) - *Plan de déplacements enterprise* (PDE)
	- Infrastructures for rail and road (inter/suburban) - Urban / suburban interactions	- Localized transport networks (scale of agglomeration) - Urban / suburban interactions - Multi–modal hubs	- Localized networks–project pathways, individual connections, multimodal hubs
Key Choices	- Interaction between choices of activity localization and demand for mobility	- Interactions between urban and suburban transport network connects and means of concentrating development around hubs that are served by public transport	- Impacts of density and transport service along project corridors

Given that to date the integration of GHG mitigation criteria appears to have occurred principally in the PDU and individual projects, this chapter will focus principally on these decision-making processes. Nevertheless, it should be noted that methods of integrating GHG criteria in both the SCOT and the PLU are currently being developed (see Chapter 6 for more information).

Analyzing the mainstreaming of greenhouse gas mitigation into the urban passenger transport decision-making process requires a two-pronged approach. First, an analysis of the decision-making process itself must occur to understand how the participative decision-making process fosters learning and trust among actors, as well as how environmental criteria in general are integrated. As such, Section 2 briefly presents the decision-making process for the development of transport plans and projects to understand how actors are integrated. This section also analyzes the statutory environmental evaluation, the principal method through which environmental issues are integrated into decision making, in order to identify general barriers to the integration of environmental criteria. Second, it is equally important to analyze the individual information tools used within the process. Section 3 draws upon the case studies of Grenoble Alpes Métropole and Nantes Métropole to analyze the GHG information tools used to date. Finally, Section 4 draws conclusions concerning implications and potential limitations to mainstream greenhouse gas mitigation into the transport decision-making process.

2. INTEGRATION OF ENVIRONMENTAL CRITERIA INTO TRANSPORT PLANNING: LEARNING FROM EXISTING PRACTICE

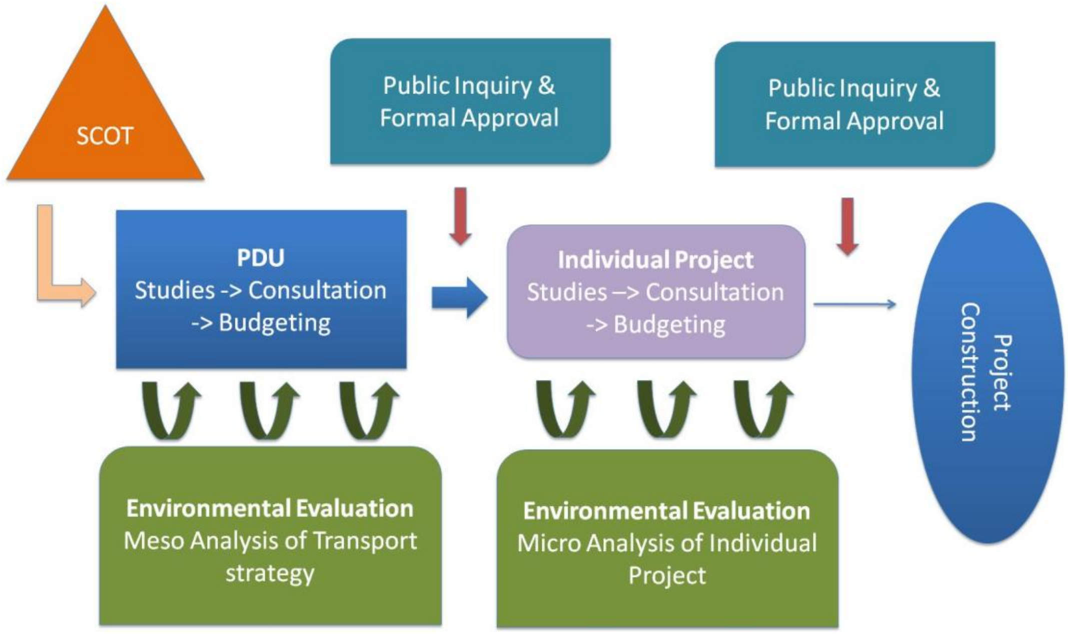
As has been noted in previous chapters, greenhouse gas mitigation has typically been treated as a new environmental constraint on policymaking. As such, its integration into sectoral policy–making processes appears to have taken a similar approach as other, more traditional, environmental criteria (air and noise pollution, water contamination, etc.). Drawing from the literature, existing studies, as well as the case studies conducted for this dissertation, this section analyses the decision-making process surrounding the development of the PDU, focusing particularly on the *evaluation environnementale* or the statutory environmental evaluation that must be conducted for plans and projects reaching a certain threshold. This analysis attempts to identify existing procedural limitations that currently limit the integration of environmental criteria that will potentially equally limit the mainstreaming of GHG mitigation.

2.1. The PDU Decision-Making Process: a Decentralized Technocratic Process

The transport decision-making process in France is characterized by two principal processes. The strategic mandates outlined in the *Schémas de Cohérence Territoriale* (SCOT) establish the larger development guidelines for the territory. These elements feed into the development of the *Plan de déplacements urbans* (PDU), which, in turn, sets the strategy and plan of actions within the urban area for the next five to ten years. Once projects are approved within the PDU, a second decision-making process occurs surrounding their technical structure and implementation, and eventually, their construction.[95] Both stages of policy development are subject to public comment periods (*enquête publique*), as well as an environmental evaluation, both of which are described in detail in Annex 5. The following section first looks at the potential impacts of integrating GHG mitigation into the different levels of decision-making. Second, the processes surrounding the development and implementation of the PDU are briefly presented and analyzed.

[95] It should be noted, however, that projects can be characterized by existing independently of the PDU documents, often predating not only the requirement itself, but–in some instances– the obligation to produce a PDU in general.

Figure 18: Cycle of Urban Transport Decision-Making in France



2.1.1. Decision-Making: the Plan de Déplacements Urbains

The transport decision-making process can be divided between the development of the *Plan de déplacements urbains* and the process surrounding the approval of individual transport projects. While a full description and analysis is beyond the scope of this chapter (see Annex 5 for a more detailed analysis), it is, nevertheless, important to review a number of relevant points for the following analysis. The legal framework for the development of the PDU established by the French State leaves the structure of the process up to the local *Autorité organisatrice de transports urbains* (AOTU–see Chapter 3 and Annex 4 for more detail) charged with managing the process. While the State does not formally define the stages of development of the PDU, it has put forward a number of guidelines, which aim to "streamline" the process (CERTU/CETE 2007).

The statutory environmental evaluation is the principal means of incorporating environmental criteria into the PDU decision-making process. The process should, in theory, be iterative and accompany the entire development of the PDU, thus ensuring that environmental considerations are on the policy agenda from start to finish, influencing both initial framing as well as subsequent evaluation. A final report must be developed by the AOTU to identify, describe and assess the likely impacts of the implementation of the draft PDU on the environment. Once the draft project and the environmental evaluation have been completed, the draft PDU is formally approved for consultation by the executive body of the AOTU (*l'arrêt du projet du PDU*).

Box 2: Steps in the Development of the Draft PDU

The State has recommended a number of steps to follow which are typically followed by most AOTU in the development of the PDU. These include:

- identification of principal issues and framing of the process;
- initial diagnostic study;
- establishment of draft objectives and defining the terms of reference (for studies, contracting, etc.);
- completion of analysis and diagnostic;
- formalization of objectives;
- elaboration and comparison of different transport scenarios;
- choice of scenarios and definition of the global strategy;
- elaboration and finalization of PDU proposal.

At the end of these various steps, a draft PDU should include proposals for action at various levels (infrastructure, organization of supply, regulation, traffic control, pricing, communication), as well as the integration of all modes of transport and parking, transportation and deliveries of goods. At this stage, proposals for financial programming and simulations must be included, along with an assessment assuring consistency with the established objectives.

Source: CERTU/CETE 2007

In addition to the environmental evaluation, a number of statutory and optional public consultations occur during the development of the PDU (see Box 3). Following these consultations, a formal public inquiry begins on the draft PDU as it was adopted by the AOTUs. However, it is important to note that if significant changes are made to the PDU, it may be necessary to update the environmental evaluation and repeat the public inquiry process.[96] Once any modifications have been finalized, the executive body of the AOTU can legally approve the final PDU, at which time it becomes legally enforceable against private individuals and public entities.

Once the PDU has been approved and passed the budgeting stage, the development of individual projects is more varied than that of the PDU documents themselves. Project developers (whether the AOTU or a contracted body) may choose to conduct equally optional studies, such as preliminary studies looking at project feasibility. If projects meet legal thresholds,[97] they must equally undergo an environmental evaluation and public–inquiry

[96] It is important to note, however, that while public consultations are necessary, the AOTU is not obligated to follow the submitted opinions. However, the fact of not following a negative opinion can still have adverse consequences on the draft PDU. Indeed, these notices are attached to this project subject to public inquiry; they can influence the investigating commissioner and push to make an unfavorable opinion, if necessary. (CERTU/CETE 2007)

[97] Up until the 2010 *Grenelle II* legislation, only projects with a budget over 1.9 million Euros were subject to an environmental–impact study. However, since the *Grenelle II* legislation, this threshold has been abolished and a

process as described for the PDU. For individual projects, (also detailed in Annex 6), it should be noted that two project-related impact studies are required: *evaluation environnementale*) and the "*Enquête publique préalable à la déclaration d'utilité publique.* Drawing on a long tradition of project-related impact studies, the environmental evaluation must be conducted before the beginning of the public inquiry, and represent a broad analysis, including socio-economic aspects and health and environmental impacts on the populations affected (Poutchy-Tixier 2004). Once the environmental impact study is completed, it is integrated into the larger set of documents assembled for the public inquiry necessary for the Declaration of Public Utility.[98]

Box 3 : Statutory and Requested Public Consultation

The widespread inclusion of public participation in decision-making has occurred relatively recently in France. Following a growing critique and the identification of a lack of representative democracy concerning the development and environmental impacts of transport infrastructure in particular, the early 1980s saw a generalized increase in the role of the public in the decision–making process (Damart & Roy 2009). Once approved by the AOTU, the draft PDU must pass through a period of public inquiry and consultation. First, the draft PDU must be submitted for review to municipal councils, general and regional actors and the *préfets* for a response within three months. During this process, the AOTU seeks the expert opinion of the State (through the *préfet* and the decentralized service) concerning the draft PDU's consistency with national guidelines and other planning documents (SCOT, etc.). The *préfet* must judge the quality of the environmental report attached to the draft PDU and how the environment is taken into account in this project (described further below) as well as indicate the conformity to national legislation. Equally, the AOTU, if requested by these stakeholder groups, is obliged to consult with representatives of the professions and public transport users as well as associations representing people with disabilities or reduced mobility, chambers of commerce and industry associations, along with recognized (*agréée*) environmental groups.

2.1.2. A Process Marked by Perfunctory Review rather than a Discursive Process

Changes begun in the 1980s in the decision-making process surrounding urban public transport plans and projects have pushed the process towards opening up to a greater number of actors. However, the above analysis suggests that this opening through the development of a system of consultations and public inquiry appears to fall short of the analytical-deliberative processes as called for by Dietz et al. (2008) in criteria for the environmental governance. In theory, while the current development process surrounding the PDU and the individual transports may lead to the "*involvement of interested parties in informed discussion of rules,*"

new set of criteria, introducing notably impacts on human health, are currently being elaborated by the *Conseil d'Etat* (CERTU 2010).

[98] The *déclaration du projet* takes into consideration the potential impact, the opinion of the State concerning the environmental–impact study and the result of public consultation. This *déclaration du projet* is necessary to issue the required work permits to begin project construction (*Article L126-1 Code de l'environnement*).

this appears important to the integration of GHG and other environmental criteria to the decision-making process as described in Chapters 3 and 4, and there are often different framings among actor groups that can affect what issues are prioritized for action and which policies are deemed appropriate. However, it may function in practice more as a perfunctory review of an already–established choice than the development of trust and reciprocity that can facilitate the development of a common project learning on GHG mitigation.

In terms of integrating different actors into the development of the PDU, the formal development process, the creation of a *comité de pilotage* and a *comité technique* have been important steps to ensure that, at minimum, a number of necessary actors are present (see Annex 6). The addition of the consultation process while, in theory, expanding the scope of the actors involved, is faced with the limitation placed within the process. In general, while consultations are advised at different moments within the process and can take the form of different presentations, processes, etc., this can be seen as a procedural step to avoid legal action linked to deviations from statutory procedures.

The principal difference from the framework developed by Dietz et al (2008) appears to be that consultation is often structured as an additional "input" rather than an organized discursive process. As such, this "one-off" occurrence does not present the opportunity for an iterative dialogue among the different actors and the AOTU or any other elaborating entity to form. Second, the draft project presented will most likely not be substantially modified after entering into the public–inquiry process. While the marginal changes can and are often made, given that significant modifications would require a second consultation process and public inquiry, their scope is most likely limited. It is important to note that larger transport strategies are typically path dependant and may not change radically from plan to plan, or project to project. As such, the lack of an iterative process can limit what Dietz et al. (2008) have identified as necessary to initiate a collective–action process. This can equally influence issues of coordinating actions among the different entities involved in the later implementation of these plans and projects, as discussed in Chapter 3.

2.2. Mainstreaming the Environment: the Limitations of Statutory Impact Studies

As discussed above, the principal means of incorporating environmental considerations into planning and development has taken two, overlapping tracks. First, legislation from the mid-1970s has established a system of environmental–impact studies for construction and development (*aménagement*) projects. Second, the environmental assessment of "plans and programs" results from the French transposition of EU Directive 2001/42/EC of 27 June 2001 on the assessment of the effects of certain plans and programs on the environment. This legislation established that all plans and programs that have significant impacts on the environment are subject to an environmental assessment prior to their adoption. In both tracks, it is recognized that to be complete and fully relevant, the environmental–assessment process should begin as early as possible and continue through the entirety of the process.

2.2.1. An Non-Binding Assessment Presenting Impacts as well as Preventative Measures

The strategic environmental evaluation of planning documents and programs is a process that aims to assess the implications and challenges of public decisions on the environment. This information is to be used not only to improve the plan by comparing different alternatives, but also to encourage participation and public information. As translated into the French legal code from the EU Directive, the role of environmental assessment is not to penalize a plan or program, but, rather, a tool to be used in its elaboration with the goal of anticipating effects on the environment and improving the project. The environmental assessment is to occur throughout the development process and culminate in a statutory impact study that identifies, describes and assesses the significant effects on the environment that may result from plan or project. This report presents the measures planned to reduce and, wherever possible, prevent negative effects on the environment. It describes the alternatives considered and the reasons why the project has been selected, especially in terms of protecting the environment. It is recommended that the environmental–evaluation process occur parallel to the entire development of both the planning documents and the project. This process can take the form of initial impact studies, working groups, etc. However, as defined in *Section A. 122-3* of the Code of the Environment, the principal objective of the environmental evaluation is the production of the environmental–impact study, not necessarily the process by which it occurs.

Once the environmental impact study is finalized and approved by the competent decision-making body[99], it is submitted to the designated environmental authority[100] for review. The environmental authority has two to three months, starting from the date of reception, to conduct its review, depending on the type of evaluation. The document is considered approved if the review is not completed within the given time period. The opinion of the environmental authority should address both the quality of the analysis and how the environment is taken into account in the project. It comprises an analysis of the project, an analysis of the completeness of the impact study, including the quality and appropriateness of the information it contains, and an analysis of the consideration of the environment in the project, including the appropriateness and adequacy of measures to avoid, reduce or offset impacts. The opinions expressed by the environmental authority and information relating to a notice must be made public electronically on its website.

Once the public inquiry or consultation is complete, the planning document or project proposal must be updated to present how the environmental evaluation and the public consultation have been taken into consideration. It is important to note that the opinion of the environmental authority is considered only as an additional element that should be taken into

[99] This *competent authority* is charged with the licensing decision, approval or execution of a plan or project, eg. the mayor, a local authority, or AOTU etc

[100] The environmental authority is charged with assessing the consideration of environmental issues in the project and issues an opinion structured to inform the statutory public–inquiry process. In the case of projects led by local authorities, the relevant environmental authority is the ***préfet de région***. In the case of plans and programs, the applicable environmental authority is the ***préfet de département***.

consideration. However, there is no legal requirement to accept and implement the decision of the environmental authority: the AOTU is only bound to justify the choice of actions taken.

2.2.2. Evaluating Planning Documents: Limitations on Anticipating and Ensuring Consistency of Objectives across Jurisdictions and Levels

The environmental analysis of the PDU has several objectives:

- Establish a thorough understanding of the territory in question and document the initial state of the environment and its evolution;
- Ensure the appropriateness of choices made through the measurement of impacts and regularly testing for consistency with environmental objectives;
- Inform citizens about the issues and results of policies implemented;
- A mandatory ex-post evaluation after 10 years.

The environmental evaluation of PDU documents must include a number of components designed principally for use in the public–consultation process. These range from an analysis of the initial state of the environment and trends, the potential impacts of the actions and strategies outlined within the PDU, as well as the actions envisaged to prevent, reduce and offset the negative effects of the PDU.

To date, the environmental evaluations of PDUs have focused principally on a widespread concern for air pollution and GHG emissions. Two recent studies conducted by the CERTU (2010) and the CERTU/CETE (2011) have identified the different environmental aspects taken into consideration in the environmental evaluation continued in 14 PDUs.[101] The two studies indicated that different environmental themes are treated unequally in the environmental evaluation, identifying two groups of issues. The first group, or those that appear to be treated most frequently and in the most detail include air quality and health, noise pollution, greenhouse gases, energy use and urban sprawl (*consummation d'espace*). The second group, treated with less rigor, includes the natural environment, water, heritage (*patrimoine)*, landscapes and risks (2010:12-13). In particular, this study reveals that in the PDUs analyzed, the air pollution-health and GHG emissions were the most systematically treated (12 of 14 cases), with a number of issues, such as GHG emissions and energy use, treated conjointly.

However, these same reports have characterized the resulting analysis as often superficial. The CERTU evaluation of the environmental evaluation of PDU documents has identified a number of problems that run through the evaluation process, from the initial description of the state of the environment to the indicators for follow-up. Often there appears to be little linkage among the different sections, whether the report has been produced in-house or by external consultants (CERTU 2010; CERTU/CETE 2011). In general, two principal sources of limitations are identifiable. First, the initial assessment of the environment has many deficiencies, often originating from the data chosen to be used

[101] CABRI (Saint Brieuc) ; Grand Nancy ; Perpignan Méditerranée ; Pays Voironnais ; Territoire de la Côte Ouest (La Réunion) ; Reims Métropole ; Nîmes Métropole ; Rennes Métropole ; CANCA (Nice) ; CASA (Sophia-Antipolis) ; CC du bassin de Pompey ; AgglO (Orléans) ; Agglopole Provence (Salon-de-Provence) ; Clermont Communauté (Clermont-Ferrand)

(availability, scale, detail, exploitability). Second, a second grouping of evaluations begins with a detailed initial assessment, that, however, remains poorly exploited or analyzed. The authors identify a number of reasons, including:

- Poor level of description of the actions to be taken in the PDU itself;
- Lack of expertise in data mining: analysis for prioritization, GIS skills for mapping operations, etc.;
- Difficulties in determining the level of precision achieved in the analysis of impacts;
- Difficulties in understanding the impacts of certain types of actions, especially when their effects are indirect.

As such, it appears that the evaluation process cannot fully succeed without clearly defined actions within the PDU, the data and technical capacity to process the data, as well as a clear understanding of how the defined actions directly or indirectly impact the environmental characteristics of the territory in question.

Table 46: Critique of Environmental Evaluation of Plans (PDU)

	Planning Documents (PDU)
Credibility - scientific adequacy of the technical evidence	- Limited scope of data chosen to be used (availability, scale, detail, exploitability) - Poor level of description of the actions to be taken in the PDU itself - Lack of expertise in data mining: analysis for prioritization, GIS skills for mapping operations, etc. - Difficulties in determining the level of precision achieved in the analysis of impacts - Difficulties in understanding the impacts of certain types of actions (reports of traffic on the natural environment, for example), especially when their effects are indirect (effect of urban sprawl fostered by improving the accessibility of some areas).
Legitimacy - perception of the production of information valid	- Self-evaluation of the PDU by the AOTU (moral hazard) rather than an external body
Saliency– relevance of the assessment to the needs of decision makers	- Often launched late (ex-post) rather than ex-ante to develop the draft PDU (validation vs. tool) - Ex-post evaluation of a single scenario, rather than a tool used to compare competing packages of actions

Finally, as seen in Figure 18, the environmental evaluation process for planning documents is intended to accompany the development of the *Plan de Déplacements Urbains* from start (initial studies) to finish (ex–post evaluation). As such, the report of the initial state of the environment is to serve as a basis to develop the principal actions and axis of the PDU. However, to the authors of the recent CERTU report, it appears that the environmental evaluation is often launched relatively late in the development of the PDU, thus limiting its ability to serve as a tool to enrich the document and serving more as a simple means to validate the content (CERTU 2010; CERTU/CETE 2011). While it is clear that this was often the case, given that the environmental evaluation was officially required starting in 2004, it has also held true for PDU projects launched after this date. Rather than serving as a means to decide among different “packages” of actions during the development, its role within the development process is limited to an ex-post validation of an existing PDU and, thus, diminished. Applying Cash et al.'s framework (2003), the different limitations on the credibility, legitimacy and saliency of the position of the environmental evaluation within the larger decision-making process is summarized in Table 46.

2.2.3. Environmental Evaluation of Individual Projects: the Dominant Role of Cost Benefit Analysis

The environmental evaluation of an individual transport project is carried out by the contracting authority (*maître d'ouvrage*) or under its responsibility. Its purpose is to integrate environmental and health issues throughout project preparation and accompanying decision-making. The analysis is expected to identify the effects of the project as well as to identify and integrate measures to mitigate harmful impacts. Prior to the 2010 *Grenelle II* legislation, the definition of which projects must undergo an environmental impact study had been relatively vague. To date, projects valued below 1.9 million Euros are not subject to an environmental impact statement unless specifically noted by law.

The principal critique of the environmental evaluation of projects stems from a larger critique of the cost-benefit analysis approach and its integration into decision-making processes in general. As opposed to the environmental evaluation of planning documents, the analysis of projects in France has long been dominated by cost-benefit analysis. Since the 1960s, the use of cost-benefit analysis has allowed "decision-makers to 'rationalize' their budgetary choices" (Poutchy-Tixier 2004:48). This approach tends to incorporate a broad range of economic, social and environmental impacts linked to a potential project and translate them using the economic surplus theory into a single, comparable, monetized denominator. As the benefits, and "costs", of cost-benefit analysis both in general and in the specific case of the French context itself have been extensively addressed elsewhere (see Boiteux, 1996; Kaufmann et al. 2008; Poutchy-Tixier 2004:48; Quinet 2000, 2006, 2011), this issue will not be treated in depth here. However, it is important to note that in the past decade, the predominance of this approach has been increasingly called into question in terms of its relevancy to decision-making.

While there is little critique concerning the rigor of the precise and technically sophisticated methods employed in France, there has been increasing doubt concerning its integration into an evolving decision-making process (Kaufmann et al. 2008). As Quinet (2000, 2006, 2001) notes, cost-benefit analysis has been highly critiqued for a number of reasons in terms of its use by decision-makers. First, its technical nature makes it often prohibitive for easy appropriation by actors. Often, as it is understood by decision makers as a "black box" producing results through a system of difficultly-understood calculations and assumptions that can be susceptible to manipulation to produced desired results. Second, while CBA may indicate the total social cost, it often does not indicate what the *distribution* of these costs is. As such, for decision-makers who are often concerned by the "indirect effects" on different populations, the information is not seen as pertinent in their political calculations.

Third, and perhaps most relevant to the issue of position of the environmental evaluation of projects, is the timing of the cost-benefit analysis within the larger decision–making process. Again, as Quinet notes, “There is an essential contradiction in the use of CBA, a kind of “uncertainty theorem”: CBA is the most useful when the list of projects is not yet decided; but unfortunately at this stage, the information on each project (cost, traffic, environmental effects) is sparse, and CBA is inaccurate, or even impossible to achieve” (Quinet 2006:14). As such, the environmental evaluation as a tool to improve individual projects may have only marginal influences on the project itself, as at this stage relatively few modifications are possible. Given the nature of the recommendations produced by the environmental–evaluation process and the relatively small ability to lead large-scale changes in the project, it is rare that this process has an impact on the choice between two substantially different scenarios or whether the project moves forward or not. As such, the analysis may need to focus further upstream in the planning process when systemic – rather than marginal choices – are made. However, given the few details available in these early phases, cost-benefit analysis appears less suitable for analysis.

Table 47 : Critique of Environmental Evaluation of Projects

	Projects
Credibility - scientific adequacy of the technical evidence	- Little information available in terms of the quality of the analysis produced
Legitimacy - perception of the production of valid information	- “Black box” nature leads the results to be seen as uncertain and easily manipulated. - Technical nature limits comprehension and appropriation - Seen as procedural justification
Saliency– relevance of the assessment to the needs of decision makers	- Identifies total costs, but not their distribution - Aggregation of impacts in CBA does not allow for the identification of effects of individual actions - Timing of analysis does not allow for the comparison of scenarios , but, rather, the analysis of marginal modifications linked to a single highly-detailed project

2.2.4. Environmental Evaluation–a Lack of Saliency Due to Timing and Techniques

The analysis of the environmental evaluation of plans and projects in France touches upon a larger question of when expertise, in general, is most useful in policy decision making. The critique of this process can vary in function of the type of decision making occurring, whether discussing a planning document, such as a PDU, or an individual project. As seen above, the limitations of the environmental analysis in terms of credibility, legitimacy and saliency vary between the two processes. While in terms of projects, there is little critique of the *credibility* of the methods used to calculate the information, much progress remains to improve the methods to analyze environmental issues of the planning documents. However, the *legitimacy* of how the analysis is conducted can be questioned, principally concerning the hypothesis made and the simplifications used. In general, highly technical and sophisticated methods employed have limited the ability of actors to grasp and appropriate results, thus rendering the legitimacy of the results questionable.

The larger issue at stake appears to be the s*aliency* of the environmental evaluation process, or, rather, whether the information produced responds to the needs of the decision makers at the moment that it enters into the process. It is recognized that the cost-benefit analysis conducted to measure the impact of projects, and, more recently, planning documents, has its limits in terms of responding to these needs. While total costs are helpful, the distribution of these costs–a much more politically relevant question–is often not easily visible. Second, the issue of timing is key. Rather than occurring during the initial or mid planning stages, where changes can still be made, the information "arrives" at a moment when there remain few substantial choices that can influence the structure of a project or even the choice among competing projects. Decisions makers need guidance further upstream, where traditional cost–benefit analysis is less able to assist them in their task of establishing long-term strategies and understanding their implications (Quinet 2011:51).

3. GHG MITIGATION AND THE ENVIRONMENTAL EVALUATION OF TRANSPORT PLANNING: LESSONS FROM TWO CASE STUDIES

As seen in the above sections, while environmental issues have been integrated in the urban transport decision-making process in France, a number of barriers appear to limit mainstreaming. First, the development of a system of consultations and public inquiry appears to fall short of the analytical-deliberative processes called for by Dietz et al. (2008) in criteria for environmental governance. While, in theory, this consultation process may lead to the "*involvement of interested parties in informed discussion of rules,*" it appears to function more of a perfunctory review of an existing project rather than a process through which trust and reciprocity can be built and learning facilitated. As such, the appropriation of the subject by decision-makers and the integration into decisions is limited. Second, the timing and integration of the environmental evaluation, the principal means of integrating environmental aspects into the PDU and project evaluation process limits its saliency and impact.

After analyzing the current practice of introducing the environmental criteria above, this section analyze**s** how greenhouse gas emissions mitigation has been integrated to date into transport decision-making in two French case studies. Applying the credibility, legitimacy and saliency framework proposed by Cash et al. (2003), the following sections look in detail at the inclusion of greenhouse gas mitigation into the PDUs and project development in Nantes Métropole and Grenoble Alpes Métropole. While these urban governments are confronted with a number of the barriers identified above, they appear to be developing innovative solutions to facilitate learning and appropriation and, thus, furthering the mainstreaming of GHG mitigation.

3.1. The Relatively Recent, but Widespread Mainstreaming of GHG Emissions

A number of recent studies allows for an overview of the recent integration of GHG emissions into the PDU decision-making process. The GART's 2010 study of the state of practice of PDUs in France identified the fact that 49% of the 61 PDUs studied took into consideration the reduction of GHG emissions as a policy priority (GART 2010:42). Only the reduction of local atmospheric pollutants (52%) and preserving the environmental quality of the urban area[102] (51%) were more widely treated. Further, the 2010 study conducted by the CERTU concerning 14 PDUs indicated that GHG emissions were one of the "better" treated environmental subjects in the environmental evaluation.

Nevertheless, a number of deficiencies were identified. While 12 PDUs studied by the CERTU addressed GHG emissions, how the planning document can have an impact on emissions was treated in markedly different ways (CERTU 2010:40; CERTU/CETE 2011). Often included in the descriptive report of the initial state of the environment (*État Initial*), the incorporation of climate change, nevertheless, ranged from a simple statement of the GHG-transport problem to quantified studies of initial conditions and emissions. The study found that when emissions from the transport sector had been quantified, the perimeter of the GHG inventory did not always correspond to the perimeter of the PDU (perimeter of the *commune,* SCOT or EPCI vs. the PTU–*perimetre de transports urbains*). Most notably, the different issues were rarely presented hierarchically in terms of their impacts on GHG emissions and the potential trends, particularly in relation to different urban–growth scenarios. In the case where emissions were presented for the territory in question, it was equally rare that they were broken down by type of mode and vehicles types.

The report equally identified a number of deficiencies in the analysis of impacts of the individual actions and measures to be taken to reduce environmental damages listed in the PDU. The study judged that the analysis was too general and qualitative, with few, if any, measures to be taken to reduce an increase in GHG emissions and a noted lack of quantification of the impacts of the different actions. Finally, few indicators were proposed within the PDUs studied to develop a follow-up and long-term ex-post evaluation of the implementation of the PDU (CERTU/CETE 2011**:** 64).

3.2. The Integration of GHG Emissions into the PDU

As described above, including greenhouse gas emissions within the environmental evaluation is a relatively new step and, as such, there is continued learning surrounding a process in continual evolution (Ranty 10.12). This mainstreaming has occurred only with the latest generation of PDU documents. For example, there was little mention of greenhouse gas emissions in the 2000-2010 PDU for Nantes Métropole, and thus, apparently, no integration into the analytical expertise. The following section will only look at the Nantes Métropole 2010-2015 PDU. Similarly, although Grenoble Alpes Métropole began the revision of its 2007-2012 PDU in the mid-2000s, this coincides with only the beginning of concern for GHG mitigation at the local-level in France. Thus, the integration of GHG emissions expertise into the decision–making process appears to have been limited.

Identifying how GHG criteria has been integrated into the PDU decision-making process, as well as understanding the direct impacts on the resulting policies and actions included in the document, is difficult to measure directly. However, the analysis of the different documents and components that make up an individual PDU submitted for approval,

[102] *Préserver environnement et cadre de vie de qualité*

as well as the positioning of these documents within the larger PDU decision-making process (see above as well as Annex 5), it is possible to have a general understanding of when and how expertise on GHG emissions has been used.

Box 4: PDU Document Components, the Decision-Making Process and GHG Emissions

As described in Annex 5, the State has recommended a number of steps to structure the PDU decision-making process (CERTU 2007). In addition to the statutory *évaluation environnementale* described above, a number of steps structure the decision-making process:

- Identification of principal issues and framing of the process
- Initial diagnostic study
- Establishment of draft objectives and defining the terms of reference (for studies, contracting, etc.)
- Completion of analysis and diagnostic;
- Formalization of objectives;
- Elaboration and comparison of scenarios;
- Choice of scenarios and definition of the global strategy;
- Elaboration and finalization of PDU proposal.

These steps, in turn, structure the individual components of the PDU, made up of:

- Evaluation and Diagnostics
- Stakes and Strategy
- Principal Orientations
- List of Actions

As well as the components of the *evaluation environnementale*:

- Initial state of the environment
- Impacts of PDU (scenarios and actions)
- Choice of project
- Compensating measures

Nevertheless, climate–change expertise appears to have been integrated principally into three different portions of the PDU. In Chapter 4, the impacts of the larger climate action plans on the framing of the PDUs were evaluated. The following sections will focus on what appear to be two key steps for the incorporation of GHG expertise in the PDU decision-making process. First, GHG expertise has been integrated in the two cases into the mandatory diagnostics used to identify the principal issues to be treated both in the wider PDU as well as within the *évalutation environnementale*. The inclusion of GHG criteria holds the potential to both get GHG mitigation recognized and to take steps to ensure that it is treated through the PDU process. Second, in the two case studies treated below, assessments have been performed on both the individual actions proposed within the PDU, as well as the scenarios elaborated for comparison. Including GHG criteria within the evaluation of individual actions and scenarios is important to understand how different packages of measures (Chapter 2) influence medium- and long-term emission profiles. Finally, the inclusion of GHG criteria into the cost-benefit analysis of an individual transport project, the Line E Tramway in Grenoble Alpes Métropole, is reviewed.

3.3. *Diagnostics*

The diagnostic phase of the PDU process serves to characterize the initial state of the environment as well as indentify initial trends. The integration of greenhouse gas emissions measurements within this stage of the process, in theory, allows decision makers to identify the sources of emissions as well as the order of the magnitude of the problem. One of the first steps in the development of the new PDU, the diagnostic phase is key in identifying and prioritizing the principal issues and priorities for the entire process. Table 48 presents an analysis from the Nantes and Grenoble Alpes Metropole case studies.

Table 48: Greenhouse Gas Mainstreaming: Diagnostics

	Credibility	Legitimacy	Saliency
Nantes Ex-post diagnostic of 2000-2010 PDU	- Newly developed methodology (first of its kind)	- Limitations of external consultant	- Positive in terms of timing - Limited ability to identify means of reducing emissions (aggregate reporting) - No tracking of changes over time or sources of changes
Nantes Diagnostic Environmental Evaluation 2010	- Use of nationally/internationally recognized methods	- None identified	- Positive in terms of timing - Limitations through use of national averages - Limitation due to not knowing why trips occurred, just location of emissions
Grenoble: 2007 Diagnostic PDU (territorial inventory)	- Locally developed methodology created by respected experts	- Limitations of external consultant	- Positive in terms of timing (early in process) - Limited ability to identify - means of reducing emissions (aggregate reporting)
Grenoble: Diagnostic DEED	- Use of nationally/internationally recognized methods	- None identified	- Positive in terms of timing (early in process) - Relevancy of input data (transport survey every 10 years)

3.3.1. Nantes Métropole

In the development of Nantes Métropole's 2010 PDU, greenhouse gas emissions stemming from transportation were integrated into the diagnostic of the PDU at two points. First, in the ex-post diagnostic of the 2000-2010 PDU, an existing territorial greenhouse gas inventory[103] was used to identify transports as a principal source of GHG emissions (29% of emissions and 22% of energy consumption).

In terms of *credibility*, few questions have been raised concerning the methodological approach used, as this was one of the first territory-wide GHG projects conducted. However, some issues were raised concerning how GHG emissions for transport are quantified, as those portions of trips occurring outside of the boundaries of the agglomeration (whether to or from) were not counted.[104] The *legitimacy* of the expertise equally has not been contested,

[103] This data stems from the 2006 Explicit study conducted using 2004 data.
[104] Only emissions for the portion of trips occurring within the perimeter of the agglomeration were counted; thus, the portion of trips occurring outside of the agglomeration are not included, even if the origin or destination is somewhere within the agglomeration's perimeter.

given the reputation of the external consultant used to produce the inventory.[105] However, in terms of *saliency,* the expertise can be critiqued, given that the results are reported in aggregate, and thus not broken down per resident or by *communes* (in terms of transport). As such, it is difficult to move from the measure itself to identifying the principal causes and the appropriate actions to mitigate emissions. Further, this diagnostic indicates neither the change between 2000-2010, nor the significant changes that have occurred leading to increases in GHG emissions. However, in terms of timing, the diagnostic is well positioned within the PDU process to establish GHG emissions as a principal consideration for the larger process.

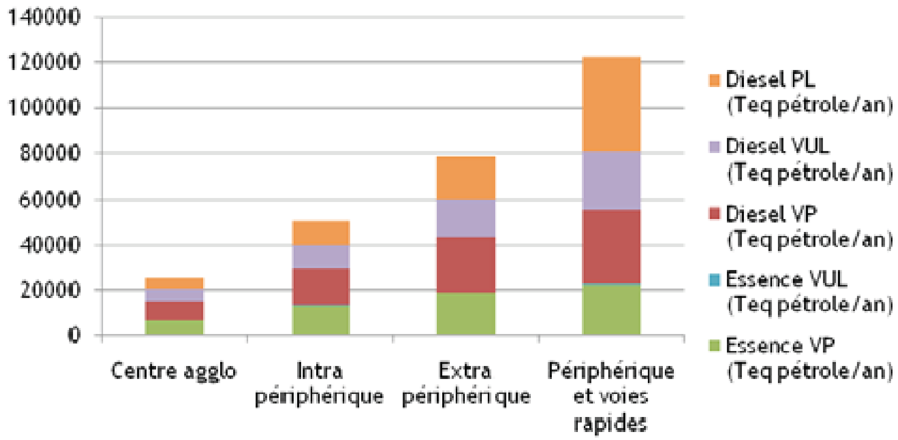
Within the framework of the Nantes 2010 PDU, the initial diagnostic occurred as part of the environmental–evaluation process. Using a different methodology than the diagnostic presented above, the 2008 traffic count data was used along with the IMPACT model created by the ADEME to calculate GHG emissions on the roadways.[106] This analysis was structured to identify what roadway networks were responsible for what percentage of emissions, breaking the results into four different categories (city-center, intra-ringroad, extra-ringroad, and ringroad/highways). Further, using national vehicle fleet data, GHG emissions were attributed to five different vehicle types.

As above, few questions in terms of *credibility* and the *legitimacy* of the analytical expertise have arisen, given that nationally and internationally recognized methods were used. However, a number of points concerning the *saliency* of the information should be mentioned. While the approach identified does give a better vision of the sources of transport emissions than the GHG quantification used in the diagnostic, a number of limitations occur due to the methodology chosen. First, the use of national averages in terms of the structure of the vehicle fleet does not take into consideration the specificity that can exist in the Nantes area. While information concerning where the emissions take place is available, there is no information concerning why the trips themselves occurred. As such, it may be difficult to identify the appropriate policy actions necessary to incentivize behavioral change. Further, while it remains unclear as to the order of magnitude in difference, given that two different methodological approaches have been used to conduct the diagnostics of transport emissions, there is no comparability between them. While the measures are complementary (total transport emissions vs. roadway and vehicle type), the presentation of different values for a similar measure that are not comparable may reduce the ability of decision makers to appropriate the information and be able to integrate it into decision-making processes.

[105] However, in order to facilitate the long-term tracking of emissions, the technical staff of the *communauté urbaine* has had some difficulty in appropriating the methodology and the results.

[106] This approach quantifies the pollutant emissions from fuel consumption data related to traffic EU-wide COPERT III program (Computer Program to Calculate Emissions from Road Transport) and the structure of the French fleet of vehicles from 1995 to 2025, developed by the National Institute for Research on Transport and Safety (INRETS).

Figure 19: Fuel Consumption by Vehicle Type and Geographical Location in Nantes Métropole (2008)



Source : Nantes Métropole 2010b:10

3.3.2. Grenoble Alpes Métropole 2007-2012 PDU

Within the 2007-2012 PDU of Grenoble Alpes Métropole, GHG mitigation was incorporated into two diagnostics. First, the annual quantification of territory-wide GHG emissions, as along with the percentage related to the transport sector, are included in the diagnostic section of the PDU document. This information was produced through a partnership between the ASCOPARG[107] and the *communauté d'agglomération*, which has tracked territory-wide emissions since 2005 (see Chapter 6 for more information on this partnership). This tool has allowed the Metro to identify the transport sector as a significant source of GHG emissions (one third of total emissions), as well as use the yearly territorial data produced by the observatory to track emissions.

As seen in the case of Nantes Métropole, this territory-wide inventory has received little critique in terms of credibility and legitimacy, given that it is conducted by trusted, long-established local expert bodies (ASCOPARG, *Agence Local d'Energie et du Climat*). Based on data from the SMTC's (*Syndicat mixte de transports en commun*) traffic model with information on fuel consumption, the emissions from non-residents of the *communauté d'aglomération* are also included. Nevertheless, similar critiques, as in the case of Nantes, in terms of the *saliency* of the information produced given the limited ability to identify emission drivers and relevant mitigation options from an aggregate measure, have been made.

Second, a more detailed diagnostic of transport-related emissions was produced as part of the environmental evaluation. Using the ADEME's *Diagnostic Energie Environnement Déplacement* (DEED) methodology allowing for a breakdown of transport emissions per resident by *commune* was conducted. Capitalizing on the local mobility survey (*Enquête déplacements de ménages*) conducted every ten years, this method focuses on the inhabitants of the *communauté d'aglomération*, and, thus, did not include transport-related emissions linked to non-residents or transit traffic. The advantage of this method is that it links GHG emissions to specific groups of actors, while at the same time taking into account information

[107] The ASCOPARG is the *local associations agréées de surveillance de la qualité de l'air*, a non-profit technical association active in the collection of data on atmospheric pollution stemming from transport and other sources.

on technology, geographic location and socioeconomic profile. This information gives actors a richer base for moving from measurement to policy.

In terms of *credibility*, the application of the DEED methodology has received little critique as it is nationally recognized and uses trusted data sources. Equally, little critique in terms of *legitimacy* of the expertise has been identified, given the respected reputation of the actors involved (*ASCOPARG, ALEc, Agence d'urbanisme*). However, in terms of saliency, it is important to note that the transport survey data is collected every 10 years, and, thus, may not reflect current trends. Compared to a similar analysis conducted by Nantes Métropole, however, this methodology has an important advantage in terms of passing from expertise to action through the breakdown of results by user and *commune*. This allows for a clearer understanding of the connection between transport and urbanism, and not just an understanding of emissions within the transport network, disassociated from other issues (technology, socio–economic status, etc.).

3.4. Evaluation of Scenarios within the PDU

National guidelines recommend that a number of scenarios, in terms of the evolution of urban passenger transport and different packages of actions, be included within the PDU development process. This exercise allows decisions makers to weigh the impacts of different combinations of over–arching strategies and packages of actions and policies. As such, the inclusion of GHG projects and evaluation criteria can potentially play an important role in understanding the impacts of different combinations of policies. It is important to note that, to date, the scenarios developed in the elaboration of PDUs tend to be binomial, often only analyzing the impacts of a scenarios "with" or "without" the actions slated to be included in the PDU rather than testing different combinations of measures. As such, the potential utility of this exercise as an ex-ante decision-making tool is limited, as different options are not compared. Nevertheless, the inclusion of GHG criteria in this process is an important first step that should be followed by the development of multiple scenarios for a more complete analysis of policy options and impacts.

Table 49: Mainstreaming GHG: Evaluation of Scenarios

	Credibility	Legitimacy	Saliency
Nantes 2010 Evaluation of Scenarios	- No critique of the technical execution	- Limited critique of self-evaluation conducted by the AOTU (potential need for externally run evaluation)	- Framing: limited usefulness of the scenarios developed (do not correspond to actual policy packages) - Timing: environmental evaluation occurs after the scenarios have been fully established
Grenoble PDU 2007-2012	- No critique of the technical execution	- Limited critique of self-evaluation conducted by the AOTU (potential need for externally-run evaluation)	- Framing: limited usefulness of the scenarios developed (black/white evaluation) - Timing: occurs after the PDU action plan has been finalized

3.4.1. Nantes Métropole

The Nantes 2010-1015 PDU has incorporated a greenhouse quantification tool into the evaluation of the different scenarios used within the environmental evaluation extending to 2015 and 2030. Taking a territorial approach, the evaluation attempts to identify the impacts of the policies and the larger strategy. The approach methodologically used focuses on individual behavior and, thus, the demand for trips themselves rather than focusing on the use of transport networks (as done in the diagnostic of the environmental evaluation described above). Changes in travel behavior were estimated taking into account the objectives of the PDU. The calculation of GHG emissions and pollutants expected from the implementation of the PDU is based on the intersection of objectives in terms of modal distribution in 2015 and 2030 and of estimations concerning population and emission factors for GHG emissions and other pollutants based on the EU COPERT IV model for technological improvement in transport modes. This analysis takes into consideration GHG emissions and other air pollutants (CO, NOx, VOC, particles) using the ADEME's *Evaluation Environnementale des PME V2.0-Juin 2005* tool. The 2008 baseline for GHG emissions was based on information from the 2008 National Transport Survey conducted by the INSEE.

Table 50 : Scenarios 2015/2030 Nantes Métropole: GHG Emissions per Capita

	GHG Emissions per capita/year	**Change compared to 2008**
Context in 2008	1.30 tons CO_2e/per capita/per annum	
2015 PDU Scenario	1.20 tons CO_2e/per capita/per annum	-7%
Compared Scenarios for 2015		
Behavior change without changes in technology	1.24 tons CO_2e/per capita/per annum	-4%
Technology change without changes in behavior	1.26 tons CO_2e/per capita/per annum	-3%
2030 PDU Scenario	0.84 tons CO_2e/per capita/per annum	-35%
Compared Scenarios for 2030		
Behavior change without changes in technology	0.89 tons CO_2e/per capita/per annum	-31%
Technology change without changes in behavior	1.23 tons CO_2e/per capita/per annum	-5%

Source: After Nantes Métropole 2010b

As seen in Table 50, the scenarios developed for analysis principally compared two different approaches in reducing emissions: behavioral change (demand for mobility) and technology change (emission intensity of transport supply). First, scenarios are divided by two time horizons of 2015 and 2030, based on the objectives established within the PDU. The purely theoretical scenario called "behavior alone" was used to highlight the gains linked only to behavior change. Not taking technological advances into account, it is based solely on a change in modal share targets of the PDU's 2015 and 2030 objectives, projected population in 2015 and 2030, etc. The scenario "technology only" was established to measure the environmental impact of a transport policy not affecting current mobility trends, but focusing, rather, on changes in vehicle efficiency, fuels, etc. These scenarios were developed using a general hypothesis concerning the development of the urban area to identify the impacts of different types of actions at different time horizons.

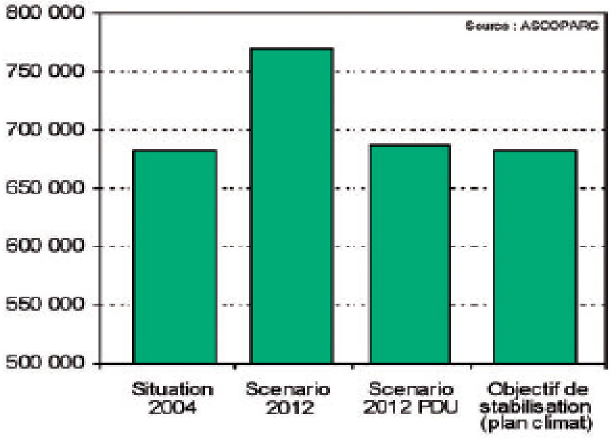
While interviewees indicated that the technical *credibility* was well recognized, there are, however, a number of critiques in terms of the *saliency* produced. First, the scenarios appear to be an ex-post evaluation of the principal of objects at the 2015 and 2030 horizons, rather than a tool to develop and compare different development strategies. The analysis appears to confirm that both behavior change and technology change are equally important in achieving emission–reduction objectives. However, the binary relationship among the sub-scenarios analyzed has limited value in terms of designing a package of policies to address transport emissions, given that both changes in behavior and technology will be targeted in any case. It does not appear useful in deterring "how much" of each type of action will be necessary; as such, there is little capacity for this information to assist in the "choice" among different scenarios or different strategies and policy actions.

3.4.2. Grenoble Alpes Métropole

Within the environmental evaluation of the 2007-2012 PDU, Grenoble Alpes Métropole also conducted an analysis of the impact of a number of scenarios in terms of greenhouse gas emission. As indicated above, the scenarios were fairly binary in nature, comparing the impacts of a situation within or without the PDU to the 2004 baseline, as well as to the larger objectives set out in the *communauté d'aglomération*'s Climate Action Plan. As the principal technical actor, ASCOPARG has estimated the emissions of greenhouse gas emissions for different scenarios. Results of this analysis has indicated that CO_2 emissions are directly proportional to the volume of automotive traffic, with short-term technological improvements of vehicles, allowing virtually no gain in this area. Their findings indicated that, while technical progress allows the limiting of emissions, the increase in average vehicle weight leads to a parallel increase in energy consumption, which results in the release of increasing levels of CO_2 (SMTC 2007). This has pushed the different actors to focus more on both actions designed to reduce the demand for mobility as well as foster technological and modal changes.

Again, as seen in Nantes, the scenario exercise has produced interesting results, as its *saliency* for decision-making appears to be limited. While the analysis confirmed that the PDU action plan would allow for a stabilization of GHG emissions from 2004 levels, it had little impact on the decision–making process itself (Gusmeroli 10.01; Poimboeuf 10.10). First, in terms of timing, the analysis occurred after the PDU action plan was virtually finalized. As such, the timing issues heavily influenced its ability to influence policy choices. Second, the structure of the scenarios compared do not provide significant analytical insights, but, rather, serve to evaluate a single set of actions in relation to the current situation and the objectives of the climate action plan. As such, the analysis has served as an ex-post validation of pre-existing policy choices and preferences that, fortunately, are synergistic with GHG mitigation objectives.

Figure 20: Evaluation of CO2 Emissions per Year in the Transport Sector in Grenoble Alpes Métropole (tons)



Source: SMTC 2007b

3.5. Evaluation of Policy Actions: Nantes Métropole PDU 2010-2015

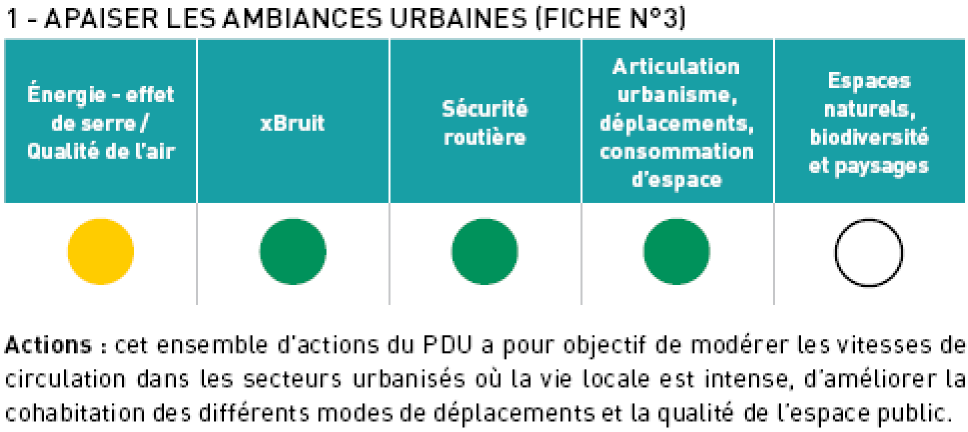
Greenhouse-gas information criteria have also been used to evaluate individual policy actions contained within Nantes Métropole's 2010-2015 PDU. In addition to the evaluation of the 2015 and 2030 scenarios within the environmental evaluation, a second multi-criteria, qualitative analysis was incorporated to analyze different actions in the 2010-2015 PDU. The impact of each of the categories of actions within the larger action plan was evaluated in terms of its impact on eight possible facets of mobility (modal share; moderation of speeds; distances; number of vehicles; fluidity/congestion; types of vehicles; cohabitation of modes; quality of urban environment (and services). In total, six environmental themes were identified[108] and analyzed, including the broad heading of "energy/greenhouse gas/air quality." Each grouping was analyzed in a qualitative manner, asking whether the action had an impact on the environment, how, and whether this impact is positive or negative, or, more generally, must be treated with caution. This, as seen in Figure 21, includes to a color-coding of actions corresponding to their impact for easy visual comprehension.

Due to the relatively-recent development of qualitative, multi-criteria approaches, a number of issues in terms of the technical viability, comparability and "accuracy" of this relatively untested methodology still remain. However, the qualitative, multi-criteria approach does allow for a level of flexibility to adapt to a wide range of different contexts. While, in this instance, the *legitimacy* of the methodology was not called into question, given the relatively subject nature of the approach, there is a risk for bias as it may be difficult to identify clearly how the impact of an action was evaluated across different criteria. Thus, the framing of the expert producing the qualitative analysis may substantially influence the results. Nevertheless, interviewees have given this method substantial praise, due to its ability

[108] Energy / greenhouse / air quality; noise; road safety; land use-transport-urbanism; wild lands; biodiversity and landscape.

to fit into the policy–making process. Most importantly, for many actors the qualitative measures were able to communicate positive and negative impacts clearly, as well as point meriting closer attention to decision-makers (Mallet 10.12; Garrigue 10.12; Ranty 10.12). As such, decision-makers can more easily compare the impacts among different environmental priorities and assess trade-offs without using a common denominator or applying a monetary value. It is further important, however, to note that this method to date is unable to indicate the scale of one impact, neither in relation to another nor across time. Thus, sacrifices in terms of GHG emissions are well worth it compared to substantial benefits in other areas or at different points in time.

Figure 21: Example of Qualitative Analysis of Grouping of Policy Actions



Source: Nantes Métropole 2010b:30

Table 51: Nantes Métropole: Qualitative Evaluation of PDU Action Plan

	Credibility	Legitimacy	Saliency
Qualitative Evaluation of PDU Action Plan	- Recent, relatively untested methodology	- Heightened ability for introduction of bias due to subjective nature of analysis	- Framing: able to clearly communicate positive and negative impacts and points of concern across different environmental priorities - Timing: environmental evaluation occurs after the scenarios already established in the 2015 and 2030 objectives

3.6. GHG Mitigation within the Environmental Evaluation of Individual Projects

While to date there has been no comprehensive assessment of the environmental evaluation of individual projects, it is possible to infer how this is currently occurring generally through National guidelines. Often the environmental evaluation appears to be integrated typically into the larger cost-benefit analysis performed for the project impact statement and the declaration of public utility (*déclaration d'utilité publique*). As seen in Table 54, the French State has set a recommended value of 32 Euros in 2010, increasing to 100 € in 2030 per ton of CO_2, which will be used in analyzing investments across sectors (Quinet et al. 2009).

Table 52 : Recommend Values for Carbon in Economic Analysis of Investments

	2010	2020	2030	2050
Recommended Value	32	56	100	200 (150-350)
Actual value (Euros 2008)	32	43	58	104

Source: Quinet et al. 2009

3.6.1. The example of the Tramway Line E in Grenoble Alpes Métropole

Part of the 2007-2012 PDU of Grenoble Alpes Métropole, the *Ligne E* project constitutes the addition of a line to the existing tramway network to serve the northwestern portion of the agglomeration within the Voreppe Gorge. The project is framed with four principal objectives: providing an alternative to the private car; improve the quality of transport supply (time savings and regularity); improve the quality of public transport (comfort and image) as well as use linked transport-urbanism development contracts (*contrat d'axe*, see Chapter 2) to facilitate a holistic urban–development program. Within the larger framing of the Line E project, the impact–assessment documents reference the objectives of Grenoble Alpes Métropoles Climate Action Plan, taken up by the PDU. As such, greenhouse gas mitigation was factored into the larger cost/benefit study at the heart of the socio-economic impact study.

A simplified assessment of emissions for the proposed Line E was performed to calculate the emissions avoided through the construction of the project. The calculations focused both on the change in total passenger-kilometers between public transport and personal car use, as well as on the changes in energy intensity per kilometer due to the modal shift. Using data gathered from the 2002 household mobility study, it is estimated that 15% of the future Line E users would have previously used their car and the project in 2014 would, thus, save 2,212 tons of CO_2 per year starting in 2014 (SMTC 2010).[109] This information is further factored into a cost-benefit analysis of the Line E project conducted within the larger impact study. The methods used, based on national guidelines, estimate benefits in 2043 of 919.12 million Euros (2009 values, excluding taxes using the State-approved 4% discount rate) with close to 85% of savings linked to reduction in time[110]. While savings from reductions in local air pollution were valued at close to 1%, savings due to GHG emission reductions only accounted for 0.1%, using a CO_2 price of approximately 17 Euros/ton (2009 value),[111] a very small fraction of the total benefits of the project. Further, the quantification of greenhouse gas emissions did not include an analysis of the GHG emissions occurring during the construction phase of the project, which are potentially high for major infrastructure projects such as this.

[109] Using urban development references employed in the 2007-2012 PDU.
[110] Time savings were estimated using a value of 14.03 Euros2009/hour as established by State guidelines.
[111] Corresponds to the value of the proposed carbon tax in 2009.

Figure 22 : Estimated Benefits from Line E Tramway Project

Savings	Benefits in 2014 (M€ 2009)	%	Total benefits 2043 (M€ 2009)
Time	17.89	84.9%	889.55
Road security	0.154	0.7%	6.20
Local air pollution	0.185	0.9%	7.46
GHG	***0.031***	***0.1%***	***1.27***
Operation cost	2.81	13.3%	14.62
Total	**21.07**	**100%**	**919.12**

Source: after SMTC 2010

In general, the methodologies deployed in the evaluation of projects stem from a long tradition of cost-benefit analysis, as well as being based on nationally established guidelines. As such, there appears to be little technical doubt concerning the quality of the technical analysis performed. Nevertheless, a number of questions can be raised concerning the methodology that may over-state the short-term benefits from time-savings in proportion to other gains. A discussion of how the different benefits of a project are valued (time-savings, security, air pollution) goes beyond the scope of this paper. Nevertheless, it is interesting to note that even when a price of 100 Euro2009/ton CO_2 is used in the calculation, the total benefits resulting from GHG reductions is close to 1%. When the State objective of a maximum carbon price of 350 Euros/ton is used, this percentage of benefits approaches 3%.

The critique of the *saliency* of the expertise to the decision–making processes follows two logics. First, given the relatively late stage within which the analysis occurs, there is little opportunity for changes within the project to have more than marginal impacts on the total benefits accrued. The opinion of the environmental authority reviewing the analysis of the project specifically noted that it is unfortunate (but not uncommon) that the evaluation did not include an analysis of different, competing scenarios (*Préfet de la Région Rhône Alpes*, 2010). Second, the relative weight of the benefits accrued from greenhouse gas reductions, in comparison to other savings, raises the question of whether this is the most impactful means of mainstreaming climate change. By reducing the value of GHG mitigation to a monetary value through a number of restrictive assumptions (value of reductions, discount rate), the issue is greatly overshadowed by more short-term benefits from facilitating increased mobility speeds and reduced travel times. While CBA is an important tool in project analysis, it appears that it may be less suited to introduce a long-term concern that nevertheless requires present-day action. As such, in terms of climate, this form of mainstreaming expertise is unable to present practical signals to decision makers in terms of what the impact of current actions and choices has on future emissions.

Table 53: Grenoble Alpes Métropole Line E

	Credibility	Legitimacy	Saliency
Grenoble Evaluation of Line E	Technical issues: - Carbon price (17 €2008 /ton CO_2) - Value of time savings (14 €/*heure*) - Discount rate (4%)	- No external verification of results (self-evaluation conducted by the AOTU)	- Timing (occurs once the majority of decisions concerning the project have been made) - Low value of GHG impact in traditional cost–benefit analysis - Difficulty of appropriating cost-benefit analysis for decision makers

3.6.2. A Movement towards Multi-Criteria Analysis?

Critiques concerning the legitimacy of this often "technocratic" analysis process and its role within an increasingly decentralized and "democratic" decision-making system have sparked a movement to develop new methodologies. As such, a form of multi-criteria analysis has begun to gain momentum, although little practical application has been seen in France. As Quinet notes, "We are now leaving a period during which the doctrine was based on the strict application of traditional economic calculation and the pre-eminence of a single criterion predicated on surplus theory, and entering a phase very firmly focused on multi-criteria analysis in which traditional CBA is only one of the assessment factors" (Quinet 2011:29). This evolution can be accredited to methodological advancements, which allow multi-criteria analysis to be possible. However, a portion of this transformation is linked to changes in institutional arrangements and public participation, along with increasing concerning for the environmental issues seen above (Quinet 2011). This change in approach led to an official internal memo published on 9 December 2008 defining a new analytical procedure focusing on the development of project aims and an assessment of how the selected project is able to achieve these objectives in comparison to other options. This comparison occurs through an analysis of project impacts, ranked in relation to the three pillars of sustainable development (the economy, the social effects and the environment) as seen in Table 11. However, as Quinet notes, these guidelines are relatively incomplete, providing little guidance on how to conduct the comparison, indicators and other methodological issues (Quinet 2011:37).

3.7. Lessons from Analysis: the First Steps towards the Sectoral Mainstreaming of GHG Criteria…

To date, the mainstreaming of GHG criteria into the urban transport decision-making process has occurred in three ways. In both cases, Nantes Métropole and Grenoble Alpes Métropole have integrated GHG emissions into the mandatory diagnostics of the territory as well as the analysis of scenarios. While not apparent in the mid-2000 PDU of Grenoble Alpes, Nantes Métropole has equally integrated a GHG criterion into the macro-evaluation of groupings of policy actions. An analysis of this mainstreaming of GHG mitigation indicates that, while some limited critique of the *credibility* and *legitimacy* of the approach used can be raised, the *saliency* of the information produced to the process presents a number of problems.

First, in terms of *credibility*, the majority of the methods used to integrate GHG mitigation into the analysis of plans and actions stem from a long tradition of highly detailed and well-respected technical analysis in France. While bias can be introduced depending on the hypotheses make by those conducting the analysis, the results are typically "analytically" trusted. However, the above section equally identified the growing reliance on a number of different quantitative and qualitative analytical tools that could potentially pose a number of issues. First, the "new" qualitative multi-criteria analysis remains relatively untested in terms of its robustness and ability to reflect potential impacts on GHG emissions accurately. Second, the multiplication of tools (diagnostic, inventory methods, etc.) treating transport-related emissions, using a different approach and data sets, produces results that are not only incomparable, but equally present a range of different values for what is often perceived as the same "measure."

Second, the largest critique in terms of *legitimacy* is that linked to the potential for bias being introduced by the party conducting the analysis–particularly in the case where qualitative methods, often perceived to be more subjective, are employed. In many instances, the AOTU is responsible for producing or delegating the production of the different diagnostic and evaluations themselves, a potentially moral hazard. In the case of Grenoble Alpes Métropole, the involvement of the ASCOPARG as a trusted actor has functioned as "a mark of quality" for the analysis. These issues will be further explored in Chapter 6.

Third, the largest limitations lie in the *saliency* of the expertise approached. While important steps are being taken towards inclusion, it remains relatively unclear as to whether this information is actually being used by decision-makers (Mallet 10.12). Limitations on its use can be linked to two issues. First, in terms of timing, as reported elsewhere in terms of the environmental evaluation in general, the incorporation of climate change as part of this process often means that it occurs late in the process. This is reflected in the different scenarios developed and evaluated within the environmental evaluation. While a technically sophisticated quantification of GHG emissions occurred, the scenarios evaluated in and of themselves had little value in the policy–making process. Rather, this appears to have been more of an ex-post validation of the strategies and actions already decided upon and, thus, not appropriated by decision-makers (Garrigue 10.12). As such, the inclusion of GHG criteria must equally be matched with an evolution in practice to produce more robust scenarios to foster the analysis of different combinations of measurers.

Limitations in terms of the *saliency* of the information are also linked to the analysis itself. The ability to move from expertise to the identification of policy actions and strategies requires that underlying sources and levers of action be identified. Choices concerning the technical methodology, such as the data sources used, the focus of the study (transport network vs. transport users, etc.) and the relevant use of national averages, can influence the relevancy of expertise produced.

Nevertheless, local governments, such as Grenoble Alpes Métropole, are taking action to improve the integration of the environmental evaluation into the entire length of the decision–making process. However, it still seems unclear as to the best methodology of introducing climate change into this process. The current reliance on heavily quantified approaches appears to limit the transition from expertise to the identification of appropriate actions or choose between two options (Poimboeuf 10.03). As such, an interesting lesson for moving forward may be the valuing of the qualitative measure over the quantified expertise within the decision–making process, as seen in Nantes Métropole's 2010-2015/2030 PDU. While quantification in terms of the diagnostic is important, in terms of guiding action a number of different actors indicated that the qualitative analysis was more effective in assisting decision makers to understand the impact of different groups of actions. The ability of the qualitative multi-criteria approach to identify where attention must be paid in terms of balancing objectives and avoiding impacts on a range of identified environmental priorities was often seen as more valuable than the quantified analysis (Garrigue 10.12; Mallet 10.12, Ranty 10.12).

While currently in the early stages of development, the 2012-2020 PDU of Grenoble Alpes Métropole appears not only to increase the role of greenhouse gas emissions within the planning process, but also to reinforce the role of the environmental evaluation in general. As discussed by a number of actors, GHG mitigation will have an important role, particularly given that much remains to be done in order to reduce emissions by 20% in the transport sector by 2020 as stated in the *communauté d'agglomération's* Climate Action Plan (Gusmeroli 10.03; Filhol 10.10). Thus, there is a concerted effort in progress to design an environmental–evaluation process that not only fully addresses GHG mitigation issues, but also functions over the entire length of the PDU development process, rather than intervening after the principal decisions concerning prioritized objectives and strategies have already been made. As such, *la Métro* has expressed the desire to develop means of rapidly estimating the impacts of different actions on a range of environmental issues, including GHG emissions, local air pollutants, noise levels, etc. (Poimboeuf 10.10; Gusmeroli 10.10).[112]

4. TOWARDS THE ROBUST GOVERNANCE OF TRANSPORT, GREENHOUSE GAS EMISSIONS AND THE ENVIRONMENT

The integration of greenhouse gas emission criteria into the transport decision-making process is the most recent change in a process that has been evolving rapidly since the 1980s. The decentralization of a number of policy competencies to local bodies in France has led to a number of changes in the urban passenger transport policy–making process concerning the role of public participation and the integration of environmental concerns. A number of voluntary and statutory public inquiry processes have been grafted onto the procedures for the elaboration of both planning documents (such as the PDU, SCOT, PLU, etc.) as well as in the development of individual projects. Equally, the mainstreaming of environmental concerns into the process has occurred, building off an existing tradition of an impact–study process for individual projects and in the early-2000s, equally spread to planning documents. These changes have questioned many of the traditional forms of decision-making, as well as the

[112] While it is too soon to know how the mainstreaming will occur in practice, a number of points can be gleaned from the terms of reference that the SMTC has produced for subcontracting the environmental–evaluation process. A number of analytical resources, including existing GHG information from the ASCOPARG, results from the PCET Observatory run by the Agence Locale d'Urbanisme and the results from linked studies, such as a study conducted within the recent SCOT development process on the greenhouse gas emissions within the greater Grenoble urban area, have been made available to the consultant company that will run the process (SMTC 2011).

methods of evaluation used in identifying the impacts of plans and projects.

The above analysis has taken a two-prong approach to understand the current state of the mainstreaming of greenhouse gas mitigation into the urban passenger transport decision-making process. First, an analysis of the wider incorporation of environmental considerations into the decision-making process itself has illustrated a number of barriers to GHG mainstreaming stemming from the process itself. Second, an analysis of the information and expertise tools used by two case studies to achieve this integration in the PDU has indicated how technical choices as well as timing can influence the credibility, legitimacy and saliency of the resulting expertise.

4.1. Procedural Limitations: Timing, Scope and Decision-Making

The first section of this chapter has analyzed the transport-decision making process in France and the integration of environmental criteria into decision making to date. The section first focused on the *inclusion of analytical-deliberative processes*, or those that foster the development of trust, engagement, and discussion. This analysis has treated the role of expertise, which appears important to the integration of GHG and other environmental criteria into the decision-making process as described in Chapters 3 and 4. There are often different framings among actor groups that can affect which issues are prioritized for action and which policies are deemed appropriate.

While a number of processes have been put into place, it appears that the development of a system of consultations and public inquiry appears to fall short of the analytical-deliberative processes called for by Dietz et al. (2008) in the criteria for environmental governance. In terms of integrating different actors into the development of the PDU, the role of the consultation process is limited by its timing within the process. Often structured as an additional "input," rather than an organized discursive process, this "one-off" occurrence does not present the opportunity for an iterative dialogue among the different actors and the AOTU or other elaborating entity. In general, while consultations are advised at different moments within the process and can take the form of different presentations, processes, etc., this can be seen as a procedural step to avoid legal action linked to deviations from statutory procedures.

Second, applying the framework developed by Cash et al. (2008) to understand the credibility, legitimacy and saliency of the information produced for the decision-making process, this section analyzed the existing literature to understand the limitations on the integration of general environmental criteria throughout the environmental evaluation. Improvement of the process has occurred; however, there are still a number of obstacles to make the public inquiry and the environmental evaluation of plans and projects more than an ex-post rubber-stamping of decisions made elsewhere. While some limited critiques exist concerning the credibility and legitimacy of the process in terms of both plans (where more sophisticated methods for multi-criteria analysis still need to be developed) and projects (where the traditional cost-benefit analysis based on a long tradition dominates), the larger issue at stake is that of the *saliency* of the environmental–evaluation process.

This question of saliency addresses whether the information produced responds to the needs of the decision makers at the moment that it enters into the process. This touches upon larger issues for the comprehension of the information, its timing within the process and its place within the larger framing of the subject. The use of cost-benefit analysis conducted to measure the impact of projects, and more recently the planning documents, has its limits in terms of the responding to these needs. While an estimate of total costs is needed, the distribution of these costs, often a much more relevant issue in moving from expertise to policy, is often not easily visible within the results. Further, timing is again an issue since, rather than occurring during the initial or medium planning stages where changes can still be made, environmental criteria tend to be integrated at a point in the processes when there remain few substantial choices that can influence the structure of a project or even the choice among competing projects. Decisions makers need guidance further upstream, where research has noted that traditional cost–benefit analysis is less able to assist them in their task of establishing long-term strategies and understanding their implications.

4.2. Mainstreaming of GHG Mitigation: Diagnostic, Previsions and Action Evaluations

The second half of this chapter has drawn on the case studies of Grenoble Alpes and Nantes Métropole to explore how greenhouse gas mitigation criteria and expertise has been integrated into the *Plan de déplacements urbains* decision-making process to date. The section has also briefly looked at the integration of a price on CO_2 emissions into the cost-benefit analysis of individual projects. Different GHG information tools have been used to date to introduce GHG evaluation criteria and analysis into the diagnostic stages of the process as well as in the construction of emission previsions related to specific scenarios and the evaluation of individual actions and projects. The case studies have shown that a range of quantitative and qualitative methods have been employed that attempt to bring the needed expertise concerning the impact of choices made in the development of urban passenger planning documents on GHG emissions. Nevertheless, in addition to the issue of timing already identified above, the mainstreaming of GHG mitigation into the case study PDUs has indicated that the *saliency* of the information produced in the process presents a number of limitations.

First, limitations in terms of saliency of the incorporation of GHG into the diagnostic process can be linked to the often highly aggregated nature of the results produced. This aggregation renders it difficult to identify the appropriate actions to take to reduce emissions, as well as what policies are necessarily responsible for current levels. Tools used by Grenoble Alpes Métropole and Nantes Métropole have used analysis methods to associate emissions with specific groups of actors, geographic location and infrastructure types; however, further efforts appear needed. Second, the integration of GHG criteria into the development of scenarios appears limited more by how scenarios are currently developed and used than by the technical inclusion of the criteria itself. While a technically sophisticated quantification of GHG emissions has occurred, the scenarios evaluated in and of themselves appear to have little value in making choices among individual actions and policy packages. This process often appears to be more of an ex-post validation of the strategies and actions already decided upon and thus not appropriated by decision-makers.

Third, limitations on the saliency of information equally extend to the observed analysis of specific policy actions within the PDU, as well as within the cost-benefit analysis of individual transport projects approved. Within the 2010-2015 PDU, Nantes Métropole used a qualitative–analysis tool to compare roughly the impacts on different criteria (air quality, climate, economic, etc.) of multiple of action types. While further development of the qualitative methodology and its use appears necessary, this type of information tool appears to allow decision makers to compare more easily the impacts among different environmental priorities and assess trade-offs without using a common denominator or applying a monetary value. Finally, the analysis of individual projects, which have been approved for construction, is typically dominated by a cost-benefit analysis. However, within this analysis, the value of GHG reductions (as well as other environmental issues) is greatly overshadowed by other benefits, such as time savings and security. While CBA is an important tool in project analysis, it appears that it may be less suited in introducing a long-term concern that, nevertheless, requires present-day action. As such, in terms of climate, this form of mainstreaming expertise is unable to present practical signals to decision makers in terms of what the impact of current actions and choices has on future emissions.

4.3. Improving the Decision-Making Process: Process and Information Tools

The above analysis has indicated that while steps have been taken to improve the urban transport decision-making process, the role of the environmental evaluation and the integration of GHG criteria, a number of obstacles still remain. As seen in Table 54, a number of recommendations in terms of strategic orientations, general policy strategies and specific modifications to current practice in France can be identified to improve this process. Both national and urban-level authorities have roles to play in fostering a more inclusive, didactic process to allow the appropriation of the climate policy challenge and the identification of means of action.

In terms of the decisions-making process, one of the principal actions to take is to facilitate the early, continued introduction of environmental and GHG issues. Ensuring that these environmental and greenhouse gas criteria and expertise are able to play a role in framing the larger debate around transport decision-making appears essential so that decisions will foster emission reductions. As such, the environmental evaluation must begin early and play a role in structuring the debate, rather than being an ex-post validation of a set of pre-determined measures. Further, the didactic nature of the process should be reinforced with the inclusion of related actor groups (users, operators, transport and urbanism departments, elected officials and agencies, as well as environmental groups and experts) to ensure the appropriation of the different questions and, thus, foster not only the prioritization of GHG mitigation, but also its linkages with other policy priorities. The current model being deployed by Grenoble Alpes Métropole with the inclusion of citizen stakeholders and experts, as well as representatives from departments and agencies across the *communauté d'aglomération*n appears to hold promise.

A number of technical issues equally need to be addressed. While, as seen in the case of PDU documents and an alternative to strict cost-benefit methods, a process of multi-criteria analysis has begun to take shape. First, the structure of the cost–benefit analysis applied may need to be revised to base values on France's ambitious 2050 objectives. Even with a price of 350 €/ton CO_2 (the State objective for 2050), benefits from GHG reductions for a project such as the Line E tramway in Grenoble remain less than 3% of total gains. As such, it appears that further reflection is needed to weigh long-term environmental costs and short-term economic gains (time-savings) in CBA better. Second, little formulization of how to carry out a multi-criteria analysis has been developed and methods remain highly heterogeneous and potentially open to biases introduced by those conducting the analysis. A move towards a qualitative, multi-criteria analysis, as conducted by Nantes Métropole in the development of their 2010 PDU, could potentially pose a number of issues. This "qualitative" multi-criteria analysis remains relatively untested in terms of its robustness and ability to reflect potential impacts on GHG emissions accurately. As such, it appears important that the State work with the necessary stakeholders to develop a robust methodology, as to date the *credibility* or technical soundness of the information produced is not often questioned, given its sound foundation on a long tradition of cost-benefit and other forms of technical analysis.

4.4. A Need for Mainstreaming across Sectors…

While important steps are being taken towards the inclusion of GHG criteria in the PDU development process, it still remains relatively unclear as to whether this information is actually being used by decision makers (Mallet 10.12). A number of actors have indicated that the steps to date to incorporate climate change into the passenger transport planning documents have had relatively little impact on the actions plans or the choice among options (Ranty 10.12; LeGal 10.12; Poimboeuf 10.10). This can be linked to the fact that since the 1990s, PDUs have mandated the objectives of reducing personal vehicle use, halting urban sprawl and fostering the development of public transportation. By default, these strategic objectives make the PDU address issues of energy use, and, thus, the reduction of greenhouse gas emissions. As such, it is unlikely that the incorporation of a "new" set of expertise addressing climate issues has had or could have a "revolutionary" impact (Herbreteau 10.12).

It appears, rather, that greenhouse gas mitigation appears to be a means of giving a new legitimacy to existing priorities and actions. As seen in Chapter 4, the introduction of the reduction of greenhouse gas emissions into the policy–making process surrounding urban passenger transport does not appear to have caused a rupture in the larger policy strategies and the specific actions put into place. Instead, the introduction of GHG criteria has given added weight and priority to a number of different policy trends dating from mandates concerning personal car use, energy efficiency, reduction of urban sprawl and the development of public transport networks. Many of the policy actions that would fulfill these mandates also lead to the reduction of greenhouse gas emissions.

Much of the above analysis touches on the larger problem of what the value is of the PDU and other planning documents in and of themselves and the impacts of the existing evaluation process. There is little doubt that the elaboration of the PDU is important and that this process can lead to the production of a concrete document typically presenting a program for transport development spanning five to ten years. This “lock-in” of a strategy and program of actions fosters not only coherence and planning tools among different sectors, such as transport and urbanism, but also affords the transport strategy a certain measure of protection from changes in politics once approved.

As such, it is conceivable that GHG information can be used to justify a project that would equally achieve other objectives. However, it is seems relatively unlikely that GHG reductions will be the incentive to reverse existing trends. This is especially the case given that mobility and infrastructure development tends to be an induced demand depending on the location of residential, commercial and leisure activities. It appears important that GHG information be incorporated not only in the choice of transportation networks and systems, but also in the decisions surrounding urban planning and territorial development. Thus, to treat transport emissions it appears necessary to integrate GHG criteria into the decision-making process surrounding the SCOT (*schéma de cohérence territorial*) as well as, potentially, the PLU (*Plan local d’urbanisme*). It equally seems important to analyze how GHG criteria and financing questions can be better articulated. This suggests that a system or hierarchy of information tools may be necessary to coordinate analysis and action across sectors and the decision-making process. The following chapter will explore the implications of such a system in terms of both its production as well as its harmonization.

Table 54 : Recommended Strategic Orientations, General Policy Strategies and Needed Modifications

	Strategic Orientations	General Policy Strategies	Specific Modifications Needed in France
French Central State	Foster: - Link decision making on transport and urban planning - Improve integration of GHG mitigation and other environmental criteria into decision-making process - Produce salient, credible and legitimate expertise for decision makers and process	Decision-Making Process: - Enforcement of existing guidelines and regulations governing the process - Binding guidelines on timing of integration of environmental information (preferably throughout the decision-making process) - Development of multiple scenarios with qualitative and quantitative analysis of multiple combinations of transport and urbanism policy packages Analytical Approaches: - Development of multi-criteria approach (guidelines, methodologies, analytical tools, linkages with co-benefits) - Re-evaluation of the recommended price of GHG emissions in investment analysis used in cost-benefit analysis (value/ton; discount rate; co-benefits; relative value to other economic, social, environmental costs)	- Require that environmental evaluation begin early and continue throughout the the entire planning decision-making process - Increase resources to préfets for analysis and verification of environmental evaluations and the role of GHG information tools in decision-making process - Use cost estimates for achieving Factor 4 (-75%) in determining the value of GHG emissions in transport - Develop national guidelines for GHG integration into the multi-criteria analysis in partnership with concerned stakeholders
Intercommunal Structure		Decision-Making Process: - Give priority to GHG mitigation and political support to make it a principal issue - Begin environmental evaluation at earliest stages and studies with increasing detail produced throughout the process - Elaboration of robust scenarios analyzing multiple combinations of policies ex-ante rather than a single ex-post strategy - Link PDU/SCOT development to influence mainstreaming of GHG criteria upstream Analytical Approaches - Use of environmental evalutations as a tool for participative discussion and learning - Foster co-construction of plans and projects with the concerned stakeholders - Develop and link decision-making information tools corresponding to different needs in the decision-making process	Develop Robust Scenarios: - Test of multiple development strategies and policy packages - Link SCOT and PDU scenarios to foster stronger connections between transport and urbanism - Ensure that the perimeter of study should occur at the scale of the urban area and may not correspond to the transport planning scenario (PTU) GHG Information Tools: - Develop didactic qualitative and multi-criteria tools to foster learning, subject appropriation and *macro-scale* choices - Produce quantitative and cost-benefit indicators and expertise to support *meso- and micro-scale* choices

CHAPTER 6:
TOWARDS A HIERARCHY OF GHG INFORMATION TOOLS: IMPLICATIONS FOR HARMONIZATION, PRODUCTION AND APPROPRIATION

1. INTRODUCTION

Expertise and information of greenhouse gas emissions is a key competent of managing climate change and a mitigation policy. As seen in the previous chapters, GHG information, whether in the form of territory-wide inventories or project-specific life-cycle analysis, creates tangible criteria and indicators to be weighted in policy decision making. While simplistic, the adage of "what cannot be measured cannot be managed" in the quantification of emissions, whether rough or highly detailed, is playing an increasing role. However, it is important that one size does not fit all: different types of actions, as seen in Chapters 1 and 2, as well as the specificities of institutional arrangements (Chapters 3 and 4) and decision-making processes (Chapter 5), place differing requirements on what GHG emissions information is needed. When the governance of greenhouse gas mitigation is seen as a polycentric process, where multiple actors across levels of government and sectoral boundaries are working towards similar, if different, structures and mitigation objectives, a wide variety of GHG information tools to support these governance processes have been observed.

As such, this chapter analyses these demands on information tools in order to understand what is necessary to facilitate both the appropriation and uptake of GHG expertise by actors, as well as facilitate GHG mitigation action. While the information tools and the numbers produced are important for policymaking, it appears equally necessary to look at how information is produced to understand its appropriation by actors. The fact that information is available does not necessarily mean that it is seen as relevant, useful or acceptable by the range of actors involved in governing GHG emissions.

Given that the saliency of GHG information tools currently in use was analyzed in Chapter 5, this chapter will look principally at the implications of the demands for an increasing number of tools and places where used to assure the credibility and legitimacy of the information produced. To do so, the following sections will first look at the nascent hierarchy of tools that appears to be developing in France. Second, the methodological implications of both the hierarchy, as well as the need to assure the credibility, legitimacy and saliency as along with the inter–operability of the information produced, is examined in Section 2. Recognizing that the information tool is often a product of its development process, Section 3 examines how GHG expertise is currently produced in France and what lessons can be drawn on the partnerships between political and technical bodies. The chapter concludes with a number of recommendations for fostering the harmonization of methodological approaches as well as for the production of GHG expertise.

1.1. Framing Information Use in Policy Making

As seen in Chapter 1, one form of information that has been widely treated in the literature is the use of quantified indicators in both public and private decision-making processes. Many authors have noted that indicators are powerful instruments in focusing attention on issues (Kingdon 2002; Zittoun 2009; Lascoumes & Le Galès 2004; Riveline 1991, 2005). An indicator is capable of presenting a complex subject in a 'digestible' form that allows decision makers to grasp a problem better. Each indicator functions in reference to a certain 'norm' of what is an acceptable value or level and, thus, allows changes or an existing condition to be compared to a 'latent' or business-as-usual state. Further, it is important to recognize that an indicator is a process of translating data into a usable fashion, which means that it is not an *a-political* technical tool. Rather, indicators are based on assumptions that are able to influence the framing and presentation of a policy problem. (Lascoumes & Le Galès 2004:31; Zittoun 2009). Given that indicators are not "straightforward recognition of the facts," it is important to understand how decisions are made concerning their construction and the actors involved (Kingdon 2002:94).

A body of research attempts to characterize the use of information in the decision–support process, whether discussing the decision making made by individuals or elected officials. Complementary to Hall and Kingdon's writing on the importance of information in problem definition and agenda setting, a number of authors have focused on the importance of knowledge, information and learning within the decision-making process (Dietz 2003, 2008; Cash et al. 2003; Tribbia & Moser 2008; Corfee-Morlot et al. 2010). These studies treat information and knowledge as a constructed part of the policy process and, thus, attempt to characterize how it is perceived by those involved. Cash et al. (2003; 2006) have attempted to identify the criteria by which information used in the decision–making process will be judged. As seen in previous chapters, they posit that the saliency, the credibility and the legitimacy of the information:

> …is likely to be effective in influencing the evolution of social responses to public issues to the extent that the information is perceived by relevant stakeholders to be not only credible, but also salient and legitimate. In the sense used here, ***credibility*** involves the scientific adequacy of the technical evidence and arguments. ***Salience*** deals with the relevance of the assessment to the needs of decision makers. ***Legitimacy*** reflects the perception that the production of information and technology has been respectful of stakeholders' divergent values and beliefs, unbiased in its conduct, and fair in its treatment of opposing views and interests. (2003:8086).

The idea that with "more" and "better" information actors will be able to produce "better" and more "informed" decisions dominates debates on the role of information in decision–making processes. Experts and scientific researches may associate "better" knowledge with "getting it right" (NRC 2009; Tribbia & Moser 2008). However, for decision makers, "better" information may be associated with reducing the margin of uncertainty within the constraints of time and cost. Additionally, much of the information and expertise used in the decision–making process around environmental subjects tends to include a large margin of uncertainty concerning the scope of impacts, cost, time horizons, etc. As such, conflicts can arise as those providing the information are torn between producing something that is timely, and, thus, salient, or as precise as possible, and, thus, in theory more credible. Further, ensuring the legitimacy of the expertise produced requires that actors trust the process and those who are involved in the process. This larger "opening-up" (Corfee-Morlot 2009) of the policy-process can, however, conflict with an information user's search for a simplified response to a specific, pressing problem.

2. FROM A CONSTELLATION TO A HIERARCHY OF GHG MITIGATION INFORMATION TOOLS

Developing and implementing greenhouse gas mitigation policies at all levels of government requires an understanding of how past, current and planned actions affect emission levels. Emissions of the six greenhouse gas emissions recognized by the United Nations Framework Convention on Climate Change (UNFCCC)[113] are typically in and of themselves intangible and often go unnoticed unless accompanied by other negative (or positive) externalities. Further, the impacts of present–day emissions may not be immediately perceptible in a single location (in terms of both time and geographical location). As such, it is necessary to devise and construct means of calculating, monitoring and evaluating not only the sources of greenhouse gas emissions, but also the direct and indirect impacts of individual actions taken to reduce them.

The previous chapters have demonstrated how the development of different forms of expertise, as well as their integration or "mainstreaming" into decision-making, policy implementation and evaluation, has begun to occur in France. As seen in Chapters 4 and 5, these tools are becoming key parts of the decision-making process, both as a means of quantifying emissions as well as didactic learning tools. However, what is apparent are the number, scope and methodological and functional diversity of the multiple tools in use. The different information tools present differences due not only to their uses and functions, but also in their level and scope of application and the sectors to which they are applied.

2.1. An Increasing Range of Uses…

As seen in the previous chapters, informational tools have multiple roles to play, particularly in the case of governing GHG emissions. Different studies, indicators, inventories and other "tools" aid in a number of decisions-making processes including:

- *Diagnostic and baseline*–profile of GHG emission sources within the area of study to identify principal sources and understand evolution over time without intervention;
- *Analysis of actions*–analysis of the direct and indirect impacts of emission–reduction policies, often linked to analyzing their cost efficiency in terms of cost per ton CO_2e;
- *Scenario analysis*–analysis and comparison of the mitigation (both direct and indirect) of potential policy "packages";
- *Tracking progress*–deployment of periodic or punctual indicators to track progress towards emission reduction goals;
- *Ex-post evaluation*–analysis of actions taken and identification of their effectiveness.

Thus, information tools are expected to perform a range of functions within the decision-

[113] The six UNFCCC recognized greenhouse gases are: carbon dioxide (CO_2); methane (CH_4); nitrous oxide (N_2O); hydrofluorocarbons (HFCs); perfluorocarbons (PFCs); and sulphur hexafluoride (SF_6).

making process. While a single tool may, in some cases, be able to fulfill multiple functions, specificities concerning the emissions and sectors included the perimeter of measure, data sources as well as time horizons and calculations methods, which may require the development of individual tools for each function.

2.1.1. … Achieving Over-Arching Coordination on Climate and GHG Mitigation…

In Chapter 4, the role of information tools in the coordination of action within the Climate Action Plan process was analyzed. Both Grenoble Alpes and Nantes Métropole have deployed multiple inventory tools quantifying greenhouse gas emissions at a number of different levels (see Annex 6 for a more detailed description of the tools). Three general types of tools have been developed to date for use in the PCET process. Territory-wide inventories have been developed by both EPCI[114] to identify emission sources, develop a baseline or reference for emission reduction scenarios and objectives, as well as track progress towards emission reduction of those targets. Grenoble Alpes Métropole has notably developed an annual inventory based principally on direct energy and fuel consumption data to track progress. While to date Nantes Métropole's territorial emissions have not been tracked annually, the *communauté urbaine* (C.U.) is currently developing a tool in partnership with the AASQA[115] *Air Pays de la Loire* to provide an annual snapshot of emissions.

In addition to the information tools being deployed by the *communauté urbaines* and the *communautés d'agglomération* presented in Chapter 4, other territorial actors have developed a number of quantification–tool inventories at different levels to assist in the management of greenhouse gas emissions. For examples, the *département de l'Issère* is in the process of developing an internal inventory of emissions related to their direct competencies and operations as required legally, but also a territory-wide accounting of emissions of all actors within their jurisdiction. Among tools, there can be substantial territorial overlap: the department inventories will include all of Grenoble Alpes Métropole, but not extend to the full perimeter of the emissions diagnostic conducted for the *Schéma de Cohérence Territoriale* (SCOT)[116] of the greater Grenoble urban area (see below). Similarly, the *région Pays de la Loire* within which Nantes Métropole is located is working with the AASQA *Air Pays de la Loire* to create a region-wide inventory in participation with the ADEME. Based on the existing air pollutant inventory in development since the 1990s, this information tool is expected to be a standardized tool to assist medium- and small-sized towns and cities, as well as rural areas, in developing their climate-related strategies (Albert 9/12/2010).

[114] *Etablissement Public de Coopération Intercommunale* – see Chapter 3.

[115] A*ssociation de surveillance de la qualité de l'air*

[116] The *schémas de cohérence territoriale* (SCOT) were established in 2000 by the *Loi SRU (solidarité et renouvellement urbain*) and lay down the general principles of spatial organization and restructuring of the urban area and are used to determine the overall balance between urbanized areas, wildlands and agriculture and forestry. Further, the documents serves to establish a certain number of over-arching objectives in terms of housing and social housing, urbanization and public transport, the protection of landscapes, as well as risk prevention.

While there is substantial overlap in terms of perimeter among the tools, the different tools have deployed different methodologies in calculating the impacts of both single as well as groups of actions on GHG emissions. As such, the different tools have different data requirements (level of detail, time horizons). The methods deployed can range from cursory estimates of GHG emissions from individual sources to complex socio-economic analysis based on quantified cost-benefit analysis principals. Further, expertise on GHG emissions is often linked to other subjects, whether they be economic (cost of ton CO2e reduced, GDP, etc.), social (accessibility to transport services, quality of housing, etc.) or environmental (local air pollution, energy use, etc.). This linking is often key in understanding how GHG mitigation is framed in relation to other, often more pressing, priorities of the different actor groups, but can add further methodological differences among methods.

2.1.2. … and Integration into Sectoral Decision-Making Processes

In Chapter 5, a second set of tools was explored that have been used to integrate or "mainstream" concerns for greenhouse gas emissions into individual decision-making processes. In the case of the *Plan de déplacements urbains*, the principal planning document for urban passenger transport in France, a number of informational tools have been deployed. Steps have been taken in mainstreaming GHG mitigation into decision making through a range of information tools calibrated for different parts of the process. These tools have been used to introduce GHG evaluation criteria and analysis into the diagnostic stages of the process as well as in the construction of emission previsions related to specific scenarios and the evaluation of individual actions. In both cases, Nantes Métropole and Grenoble Alpes Métropole have integrated GHG emissions into the mandatory diagnostics of the territory as well as the analysis of scenarios. While not apparent in the mid-2000 *Plan de déplacements urbains* (PDU) of Grenoble Alpes, Nantes Métropole equally has integrated a GHG criteria into the macro-evaluation of groupings of policy actions.

As also recognized in Chapter 5, however, further mainstreaming of GHG mitigation into other policy sectors appears necessary, not only to achieve emission reductions in the urban passenger transport sector, but also to ensure the introduction of GHG criteria across sectoral policy streams. While a full review is beyond the scope of this dissertation, steps have recently been taken in France to mainstream GHG mitigation into the development of the other strategic–planning documents related to transport and urbanism. To date, this integration has occurred principally into SCOT, although a method is currently being developed to integrate GHG criteria into the *Plan Local d'Urbanisme* (PLU).[117] Recognizing that territorial organization and the distribution of economic and social activities across the urban area can have significant impact on emissions, particularly in the transport sector, this integration is an

[117] The PLU is a statutory planning document for both public and private land development. It serves as the legally-binding reference for occupation or land use as well as the issuance of building permits, statements of work, and demolition permits. The PLUs are the principal tools for the implementation of urban policies at the commune and inter-communal level. They provide a common framework for the various public or private activities and operations and should help to ensure the coherence as well as the positive diversity of urban functions. The elaboration of the PLU is typically the responsibility of the commune; however, in some cases this jurisdiction as been transferred to the inter–communal structure.

important step towards systemic changes.

One of the first examples of this integration into the SCOT decision-making process has been conducted as part of the environmental evaluation of the SCOT at the level of the greater Grenoble urban area (*Région Urbaine Grenobloise*). Selected as one of the 12 *SCOTs du Grenelle,* this SCOT has been supported nationally in order to explore how the different objectives of the *Grenelle I & II* (see Chapter 4) can be integrated into planning documents. Designed as a means of fostering the appropriation of a "culture of carbon" among elected officials as well as defining the impacts of specific urban planning choices on emissions, this mainstreaming involved two information tools. First, a diagnostic inventory of emissions from the entire greater urban area was conducted. This information was then used to identify what strategic guidelines that could lead to emission reductions needed to be developed. A second modeling process was then conducted to understand the potential impacts of the different strategic orientations on emissions stemming from specific sectors (transport, housing and economic development). The results of these two processes were then used to fine-tune the objectives in terms of climate and energy of the SCOT before its final approval.

The development of the specific information and analysis tools necessary to foster the integration of greenhouse gas emissions criteria into planning documents is being addressed at the national level by technical support agencies. The CERTU[118] is currently working in cooperation with the regional CETE (*Centre d'Études Techniques de l'Équipement)* to develop three tools spanning the entire urban planning and development process. These different tools focus on the SCOT, the PLU and what in France is termed as *opérations d'aménagement* or specific large-level redevelopment projects. While still in development, the three tools are designed to be more than a diagnostic inventory. Their principal objective is rather to evaluate the impacts of the different actions on the environment as part of the environmental evaluation, thus, comparing the evaluation of different development scenarios (CERTU/CETE 2012). While their potential impact will be limited by whether, in practice, multiple scenarios are developed (see Chapter 5), they represent a further step in mainstreaming GHG mitigation into sectoral policy making.

2.1.3. Next steps: Performance–Based Financing?

In recent years, preliminary steps have equally been taken to fill the missing piece of the use of information tools: linking financing and GHG expertise. In partnership with other EPCI as well as a number of AASQAs, Nantes Métropole has been working on a means of linking territorial GHG inventories and performance-based financing. While still in development, the BASEMIS information tool based on existing air–quality data and methodologies could be deployed at the level of a given administrative entity. Tracking annual changes in GHG emissions across the territory, the tool is expected not only to help understand the evolution of emissions but also monetize the progress (Huré 10.12.08; Albert 10.12.09; Lavrillieux 10.12.09). Currently, the tool focuses principally on the direct emissions from actors in the jurisdiction (Scope 1), with the inclusion of some Scope 2 emissions

[118] CERTU (*Centre d'études sur les réseaux, les transports, l'urbanisme et les constructions publiques*) is a technical agency of the French Ministry for Energy, Ecology and Sustainable Planning and Development.

(imported electricity and heat). However, ensuring the fungibility emissions and a monetary value introduces multiple questions concerning the "MRV" (measurable, reportable and verifiable) quality of the data and methodology used.

While it remains unclear as to the level of precision and detail necessary for an MRV system, it is expected that this will have a significant impact on the methodological choices made. Further, a number of difficult questions must be answered concerning what policies and actions, and then which actors within the territory, are responsible for the emission reductions. This would require a traceability of the impacts of individual or groups of actions and, in theory, dictate who would, thus, benefit from financing to reductions. Potentially, this system could be limited by similar technical and capacity challenges identified in the deployment of domestic offset projects often deemed as too complicated for sub-national actors to put into place (see Chapter 4). Finally, given the often-strong linkages between macro–economic activity and GHG emissions, questions have arisen concerning the sanctions or potential fees imposed if emissions increase across the territory within a given period (Guillard 10.12.07).

2.2. Towards a Hierarchy of Information Tools: Managing a Fragmented Institutional Context

Given the fragmented institutional context within which both transport and climate policy occurs in France, there is little surprise that a wide variety of information tools have been developed. Spanning multiple perimeters, operating at different levels and cutting across issue areas, these tools play a variety of roles within the different decisions-making process. While, at first, there may appear to be little order within the constellation of tools, it appears that a loose hierarchy is beginning to take form. As seen in Table 55, when the specific case of the integration of greenhouse gas emissions into transport and urban planning decisions is implemented, a hierarchy of tools focusing on the different strategic documents and actions begins to take shape. Three different levels can be identified, corresponding to different planning documents (if perimeters are appropriately established) and the different types of decisions and actions established at that level. As such, this hierarchy recognizes that different types of decisions influencing the organization of transport and urbanism are made in different processes. This includes decisions concerning settlement patterns across the entire territory, which can greatly influence the demand for mobility and, thus, GHG emissions. In theory, when the SCOT is established at the level of the greater urban area, the integration of GHG criteria into the decision-making process would potentially allow a greater influence on settlement patterns. When paired with the integration of GHG criteria into the PDU at the *meso* level (decisions about how to provide transport services within an existing urban configuration) and individual projects at the *micro* level, GHG mitigation is potentially able to influence the majority of decisions made.

Table 55: Hierarchy of Information Tools for GHG Quantification in Transport and Urban Planning

Level	**Macro–Systemic**	**Meso**	**Micro**
Scope	- Territory	- Agglomeration	- *Commune, zone d'aménagement*, neighborhood
Planning Documents & Perimeter	- SCOT	- *Schema de Sector* - PLH[119] - PDU - PCET - PLU	- PLU - PDE - Project Documents (*Contrat d'axe*, etc.) - Individual projets
GHG Quantification of:	- Diagnostic of emissions	- Diagnostic of emissions	- Diagnostic of emissions
	- Large-level structural development scenarios	- Medium–level zoning impacts - Transport policies and development	- Zoning - Building permits - Projects
Level of detail	- "Order of magnitude" quantification of settlement patterns and choices	- Order of magnitude quantification - Some detailed studies of impacts of multi- modal hubs and connections between urban/suburban networks	- Detailed studies to identify "marginal" opportunities to reduce emissions
Methodological Approach	- Qualitative - Rough quantitative - Multi-criteria	- Quantitative / Multi-criteria - Rough Cost–Benefit Analysis	- Multi-criteria analysis - Detailed cost-benefit analysis - Life-cycle (infrastructure, other)
Sectoral Implications			
Urbanism	- Distribution of activities across the greater urban area (employment, residential, services	- Distribution of activities within EPCI - Residential vs. business districts	- Location with *communes* - Mixed-use areas - Density along public transport lines
Transport	- Infrastructures for rail and road (inter/peri-urban)	- Localized transport networks (level of agglomeration) - Urban / suburban interactions - Multi–modal hubs	- Localized networks–project pathways, individual connections, multi–modal hubs
Key Information	- Interaction between choices of activity localization and demand for mobility	- Interactions between urban and suburban transport network connects and means of concentrating development around hubs that are served by public transport	- Impacts of density and transport service along project corridors

[119] *Programme local d'habitat*

As seen in Table 55 the different levels of inventories correspond to not only different perimeters, planning documents or projects, but also have impacts on the type of GHG quantification potentially required, the level of detail and the approach taken. At the *macro* level, given that fewer specific details concerning settlement patters other than the rough localization of activities are known, a highly detailed, precise approach may be of less use. Rather, focusing more on the order of magnitude of impacts of different choices may be sufficient to influence decision making. This is true both in the diagnostic inventory to be conducted as well as in the evaluation of different scenarios and individual actions proposed. At this point in the decision–making process, where systemic changes and patterns can be set, GHG criteria can be introduced in relation to other criteria and priorities in the decision-making process. These may involve a qualitative approach, as seen in the environmental evaluation of the 2010-2015 PDU of Nantes Métropole or a rough quantification of impacts.

Integration or mainstreaming is equally important at the *meso* level or that of the individual planning documents that translate both sectoral objectives as well as the over-arching development strategies outlined in the SCOT into a specific administrative jurisdiction. At this level, choices are made concerning the distribution of activities within a smaller perimeter (PLU, PLH) as well as how this distribution can be best served by both public and private transport options (PDU). Again, both a diagnostic inventory of GHG emissions is important to support decision making, combined with the analysis of the different scenarios affecting medium-scale land-use planning and zoning as well as the transport policies that influence infrastructure construction and modal share. In this instance, given that more information is available concerning the specific details of policies and projects, detailed studies of impacts could be useful. However, an estimate–rather than a precise calculation of the order of magnitude of resulting emissions–may be sufficient to link GEG mitigation with related priorities. As such, decision makers are able to understand both the co-benefits of GHG mitigation as well as the effects of individual decisions, policies or programs on emissions and related issues. In operational policy terms, this can include the interactions between urban and suburban transport networks and the means of concentrating development around hubs that are served by public transport.

Finally, at the *micro* level, or that of an individual project, the amount of data and information necessary to conduct a full cost-benefit analysis may be available; however, the smallest room for maneuver may exist in terms of reducing emissions. Once an individual project, whether a public–transport line or the redevelopment of a neighborhood, has been approved at the *meso-level*, the choices in terms of reducing emissions from the transport sector are most likely marginal. While specific decisions concerning technologies, materials, path, etc., can influence a project's emissions, it is much more difficult to reduce systemic, large-level emission sources, such as possibly at the level of the SCOT (i.e. demand for mobility). As such, detailed studies concerning the specific means of achieving these potentially marginal reductions are important, whether focusing on multi-criteria analysis or cost-benefit analysis. Unless it is a source of substantial increases in emissions, the most important element is ensuring that a project that would occur no matter its impact on GHG emissions takes the necessary steps to be the least emission-intensive as possible. For example, when developing a new residential development, important design choices can be made to ensure its connection to the public–transport network and to ensure a mixed-use development within the development.

2.3. Section Conclusions

Reducing greenhouse gas emissions requires achieving coordinated action across and among levels of government, among multiple actor groups as well as across traditional sectoral divisions in policy making and implementation. As seen in previous chapters, this has resulted in the development of a large number of information tools used to guide the GHG mitigation process as well as introduce a GHG criterion into sectoral decision-making. However, this has led to a diverse "constellation" of tools, often adopting heterogeneous methodological choices and perimeters. Different levels of deployment, functions, and detail appear necessary for making sure that the information produced is salient for decision-making. However, it appears that a nascent hierarchy can be seen forming when the passenger transport sector is studied. Relationships among tools, planning documents and levels of details appear to follow a continuum from systemic to marginal decisions concerning GHG emissions.

However, while an inter- related hierarchy of tools may be functionally desirable, it poses a number of difficulties in terms of the methodological considerations (harmonization of methodologies, definitions, perimeters, etc.) as well as questions concerning how to produce such a coherent system within a fragmented institutional context. The case studies of Grenoble Alpes Métropole and Nantes Métropole can offer a number of lessons on how to assure their development. The following sections will analyze, in turn, the methodological implications as well as the process-based implications.

3. HARMONIZATION VS. CONTEXTUALIZATION: RESPONDING TO A COMPLEX POLYCENTRIC INSTUTITIONAL CONTEXT

The range of different methodological approaches adopted due both to the fragmented context within which information tools have been developed, as well as the variety of functions, has implications for the *credibility* of the information produced. As actors strive to develop information tools that are salient for different governance purposes (see Chapter 5), disparities in results as well as methods directly influence the perception of what Cash et al. term the "…the scientific adequacy of the technical evidence and arguments…" (2003:8086). Given the uncertainty inherent to the climate–change policy challenge, it is imperative to avoid conflicting results based on different methodological approaches, so as not to communicate mixed messages to actors. Further, the potential for flawed methodological approaches could under- or over-evaluate the importance of a given sector and, thus, the priorities for action. Finally, developing a common "*langue*" around greenhouse gas emissions intuitively requires a basic level of coherence among sector definitions, quantification methods and responsibility. As such, the methodological harmonization of inventory tools is an important step in fostering a polycentric governance of greenhouse gas mitigation.

Nevertheless, while harmonization appears necessary to a certain degree, it is equally important to recognize the need for the contextualization of methodological approaches in order to ensure the continued saliency of the information and expertise produced. This contextualization must recognize the challenges of different jurisdictional and competency boundaries, access to the needed data, as well as a need to link GHG mitigation to other policy subjects. This section analyses the necessary balance between harmonization and the contextualization of information tools and the implications for both methodological choices, as well as the credibility of the information produced.

3.1. Methodological Choices Are Important–the Devil Is in the Details

Methodological approaches chosen and the hypothesis made when developing GHG information tools can structure the results given (Gariggue 10.12.07). These choices concern a number of basic elements of the methodological approach taken. This includes *what* is being measured (perimeter, scopes – see Box 5, gases), *how* emissions are quantified and the normative question of how *responsibility* for the greenhouse gas emissions are attributed to different actors and groups.[120] These choices can significantly influence results of a given quantification of emissions, as well as inhibit comparability among tools. For example, in the calculation of their territorial inventory, Nantes Métropole has established the administrative boundary of the inter–communal structure as the perimeter. As such, only transport emissions from the portion of trips that occur within the administrative perimeter of Nantes Métropole are included. Thus, the emissions that could be attributed to the urban area (C.U.) as a regional hub for employment and workers are not included. As such, actions to work with the surrounding territory to treat this issue of transport as a regional challenge may not be framed in terms of the impacts on GHG emissions.

Many of the methodological choices touch upon larger, normative questions concerning how responsibility for GHG emissions is assigned. Clearly assigning responsibility for GHG emissions is key in resolving a number of methodological issues, such as double counting. However, it is rooted in a number of complex normative issues, as it requires a judgment as to whether consumers or producers are primarily responsible for the emissions stemming from the goods and services. Often, a pragmatic "middle ground" can be found when the capacity of actors to mitigate is taken into consideration. As explored below, the choice to use a direct–emissions (Scopes 1 and in most cases 2) versus a life-cycle approach (Scopes 1, 2, and 3) is rooted in different notions of who is responsible for the emissions, but also who is able to take actions to reduce them (Gouriten 10.12.08). As such, a number of normative, often politically and exogenously determined, variables have a central role in the structuring of inventories. Decisions establishing how responsibility for emissions

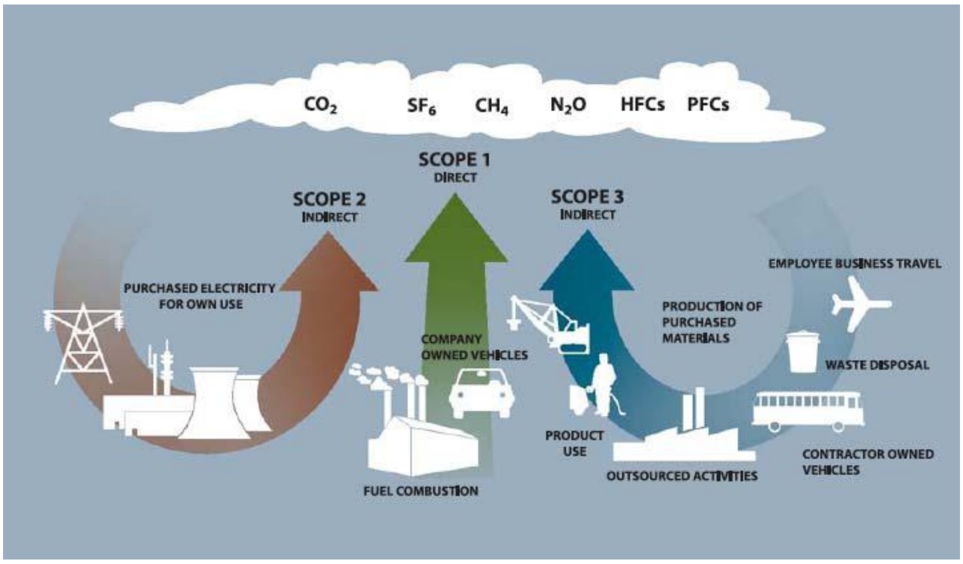
[120] The principal approaches for attributing responsibility can be divided into either production-based or consumption-based. A *production-based* approach allocates the accounting (responsibility) of emissions to the place where they are produced. As such, only emissions generated in a given territory are attributed to the city in its inventory. Conversely, a *consumption-based* approach of accounting and responsibility allocates emissions to their point of consumption. The scope of this accounting method is variable in application, ranging from a limited portion of upstream emissions to a full life-cycle analysis.

is attributed, the emission Scopes included, and the sectors and gases included are at the heart of the structure and base architecture.

Box 5: Direct, Indirect Emissions and Emission Scopes

As developed by the World Resource Institute and the World Business Council on Sustainable Development's *Greenhouse Gas Protocol* (WRI/WBCSD, 2004), there are three principal emission scopes: *Scope 1* includes the direct emissions from a project, entity or territory. *Scope 2* includes the direct and indirect emissions produced elsewhere linked to electricity, steam, heating and cooling used by the project, entity or territory in question. *Scope 3* corresponds to all indirect, up-stream and embodied emissions of goods and services consumed in the project, either by an entity or within a territory (carbon footprint approach). The choice of what is included in an inventory is linked to its exogenously established purpose. If an inventory is designed to support management of only those emissions over which an entity has direct operational or financial control, a more limited approach will be taken (principally Scope 1 and Scope 2). However, if the goal is to understand and manage the carbon footprint or the total GHG emission content (both direct and indirect) of all goods and services produced and consumed by a given person, entity or over an entire territory, a much broader definition of *what* to include will be adopted (mixture of all three scopes).

Figure 23 - Overview of Scopes and Emission Sources



Source: WRI/WBCSD (2004).

3.2. Different Approaches Will Continue to Exist

Nevertheless, while harmonization of approaches is essential, it is important to recognize that due to on-the-ground functional constraints, it must also be flexible. Due to the range of functional roles that information tools play in the governance of greenhouse gas mitigation at sub-national levels, it is important to recognize that, while harmonization is important, the need for contextualization will continue to necessitate differences in approach.

This need for contextualization can stem from what has been (or is being) analyzed (direct vs. indirect emissions), the data available and, thus, uncertainty and quantification methods, as well as the need for information tools to be linked to other measures and issues.

3.2.1. Direct vs. Indirect Emissions and Tracking

Multiple approaches will continue to exist as they serve different purposes. As seen in Chapter 4, inventory tools are being used for different purposes and, thus, often take different methodological approaches. For example, in Grenoble Alpes Métropole, the annual agglomeration-wide inventory uses a direct–emissions approach, including only those GHG emissions emitted in the territory itself or resulting from the importation of electricity or heat. While this approach may have a number of limitations in terms of capturing all direct and indirect emissions across the territory, it is much less data intensive and costly in terms of time and money than, for example, taking a life-cycle approach. Actors in Grenoble indicated that the annual budget of the observatory conducting the agglomeration-wide inventory was about 20,000 Euros while the cost of conducting and updating a life-cycle (approach *Bilan Carbone*®) type tools would range from 80,000 to 100,000 Euros per year (Poimboeuf 10.03.01).

Nevertheless, there are a number of instances where a life-cycle approach is necessary. In many instance, life-cycle cradle-to-grave emission inventories are used to understand a single process or sector in detail. This approach allows the local authority to ensure that actions that reduce direct emissions do not have a secondary effect leading to increases in indirect emissions. Again, as noted by actors in Grenoble Alpes Métropole, the development of the ADEME's *Bilan Carbone*®, life-cycle approach inventory tool in the analysis of the waste–management system played an important role in identifying how to reduce both direct and indirect GHG emissions (Poimboeuf 10.03.01). Further, the life-cycle approach does not allow for the calculating of the sum of emissions from multiple territories due to risks of double counting, since both direct and indirect emissions are included. Given that a life-cycle approach includes emissions that occur both within a given perimeter as well as from outside the perimeter, it is not be possible to calculate total emissions within a given *région* by adding the totals from the *départements*. While the use of a direct-emission approach may not exclude the risk of double counting, it is typically easier to adjust methodological approaches to avoid doing so (Militon 10.12.09).

Thus, life-cycle and the direct–emission approaches are, rather, two complementary tools; each has its relative strengths and weaknesses (Militon 10.12.09, Poimboeuf 10.03.01). As such, both methods of defining the scope of inventories will continue to be used for specific uses.

3.2.2. Limitations Posed by Data Availability

Data availability and the cost of collection equally will continue to create differences in the methodological approaches used for different inventories and by different actors. Typically, as the number of emission sources, institutions and actors increases, so does the relative data requirements and, thus, in most cases, the cost of data collection and treatment. As seen in Table 56, moving from one inventory "perimeter" to another increases the number of emission sources involved, whether grouped into projects, entities or territories. While bottom-up, detailed and verified physical data is preferable for calculations in terms of accuracy, this data concerning the different sources (fuel-specific consumption, passenger-km, etc.) is often not available and can rapidly increase costs as the number of sources increases. As such, it is often necessary to rely on a number of different solutions, including modeling and/or downscaling of top-down statistics. While the use of statistical approaches is, in some cases, inevitable, the reliance on averages, whether national or regional, may not capture the specificities of a given territory (Militon 10.12.09). As such, emission reductions stemming from policies fostering, for example, the composition of the vehicle fleet across the entire territory or certain behavioral changes may not appear in GHG inventories. While often necessary, these approaches can introduce additional uncertainty into the final results as the margin of error increases.

Table 56: Principal Data Sources by Inventory "Level" Categories*

Project	Entity	Territory
• Physical Activity Data**	• Physical Activity Data** • Model Outputs***	• Physical Activity Data** • Model Outputs*** • Down-scaling Statistical Data****

* While all methods of calculating activity data can be used at any level, this table attempts to indicate which are most common at each level.

** Physical data may include: Electricity, fuel, energy consumption, passenger-km, production values, waste mass, cultivated area, size of herds, etc.

*** Model Outputs are the estimates of activity produced using modeling techniques calibrated to the territory. For example, transport/land-use models can be used to estimate passenger-km traveled at the level of the entire territory. It is important, however, to establish the margin of error introduced by modeling techniques.

**** The down-scaling of statistical data (national or international) can be used to estimate the portion of national activity for which the territory in question is responsible.

In addition to measured physical activity data and statistical downscaling, actors may be obliged to rely on model outputs. For example, due to a lack of annual data, Grenoble Alpes Métropole uses a Visem/Davisum model to simulate transportation flows. This model, however, is highly dependent on the results of the household mobility survey (*l'Enquête Ménages-Déplacements*) which is conducted at a relatively large cost (more than two million Euros) approximately every 10 years. As such, the data used in the quantification of transport-related GHG emissions has a double uncertainty, as it is calculated through modeling tools as well as based on data that may date from as much as decade before (Poimboeuf 10.01.05).[121] Nevertheless, for the territorial-level inventory beyond the transport sector, over 70% of the data used is current measured consumption data, thus reducing the overall uncertainty for the larger inventory (Buffiere 10.10.19).

The same holds true for the accuracy of the emission factors often used to quantify emissions. The accuracy of the result is dependent on the calibration of the emission factor used. The most accurate quantification may require that *context-specific or Tier 3* emission

[121] It is nevertheless important to note that the comparison of model outputs and the most recent enquête ménage data from 2010 has confirmed the relative precision of the approach.

factors[122] be developed for activities – taking into consideration the specific context and technologies used in a given place. However, in many instances, context-specific emission factors are not available or cannot be calculated (due to a lack of funds or data). As such, actors must decide among a number of nationally-established emission factors (provided by the ADEME in their *Bilan Carbone*®) or international emission factors (developed by the International Panel on Climate Change) (Lavrilleux 10.12.9). Emission factors are important to ensure accuracy, as the greenhouse gas intensity of activities may vary widely over time and across locations as well as be directly modified by policies.[123]

This lack of data, whether stemming from availability or the cost of production, can influence the uncertainty of the resulting quantified information. Equally, in many instances, actors will establish their specific quantification approach based on what data is available– particularly when the information tool must be developed within a relatively short period of time (Albert 10.12.09).

3.2.3. Linking with Other Subjects–Weighting GHG Quantification and a Need for Multiple Indicators

An important part of the contextualization of information tools is a need to ensure the saliency of the data produced through its links with other policy priorities. First, for many actors it is important to contextualize GHG quantification in terms of other socio-economic measures. As such, the weighting of territorial GHG emissions by population has become an important means of measuring progress. However, this measure may potentially mask total increases in emission due to population growth. For example, between 2004 and 2008 per–capita energy consumption was reduced by 5.4%, while, due to a slight population increase, total energy consumption was reduced only by 4.9% in Grenoble Alpes Métropole (Buffiere 10.10.19). This linking with other indicators (GDP, square meter for building energy efficiency, etc.) allows decision makers to understand better the impact of their individual or packages of sectoral policies per unit of activity versus total consumption or emissions (Durand 10.10.22). Having a global vision of the changes in emissions, as well as a contextualization per unit of activity, etc., are both important for the decision-making process (Poimboeuf 10.0.05).

Second, as discussed in Chapter 5, linking GHG information tools with related policy subjects and priorities is important to aid in their appropriation, since, first, GHG mitigation is a relatively recent policy subject and second the inter-generational distribution of costs and benefits, linking information tools with other measures can reinforce the saliency of information. In terms of methodological choices, this implies that the connections among policy subjects be taken into consideration at the initial design stages of the tool. For example,

[122] Tier 3 factors will need to be calculated principally for those emission factors represented aggregate characteristics of the entity in question. This corresponds principally to electricity (when it varies from national/regional averages) and the local vehicle fleet (given high levels non-fossil technology, hybrid, biofuels, etc., penetration).

[123] For example, due to policies focusing on the deployment of renewable energy sources, the carbon intensity of the local energy mix may vary from national and international averages.

ensuring the saliency of GHG information in the transport sector can be reinforced when linked with data on other local air pollutants, as well as congestion and safety issues. When information is overly focused on climate, it can lose its relevancy in the debates (Filhol 10.19.2010). The need and the methods necessary to link GHG information and expertise varies among policy sectors and, thus, can lead to necessary differences in terms of methodological approaches.

3.3. Achieving Harmonization: Tradeoffs, Flexibility and Current Progress in France

Given that the above context for the harmonization of the methodological choices that structure the information tools used in the management of greenhouse gas mitigation is needed, the process is subject to a number of trade–offs as well as a functional need for flexibility. These trade–offs and limits both stem from resource and data constraints as well as the need to contextualize the information for decision making.

3.3.1. Trade–offs: Cost, Accuracy, Action and Comparability

Two trade–offs appear to influence the development and potential harmonization of greenhouse gas information tools. The first trade–off takes the form of an arbitrage between *cost* and *accuracy.* As with many policy tools, a careful weighing of the costs and benefits is necessary to ensure that it is both useful and efficient, given budget and time constraints. Typically, as the number of emission sources, institutions and actors increases, so does the relative data requirements and, thus, in most cases, the cost of data collection and treatment. For example, directly measuring GHG emissions at their source would, in most cases, produce the most accurate data. However, this is typically the most expensive, time-consuming method that is often not feasible. As such, harmonization of methods must balance between the necessary level of accuracy of emission estimates and the cost of data collection and processing and must be carefully established.

There is equally the potential for a second trade–off to emerge between *action* and *comparability,* apparent in different demands resulting from internal and external uses. While these two uses are not incompatible, the need to produce inventories whose results allow for local-level *action*, and, thus, respond to the needs of specific uses and policies, is often presented in opposition with a need for *comparability* in terms of the homogeneity of methodologies to ensure the value of results for external, comparative purposes. Care must be given to how comparability is achieved to ensure that emission reductions resulting from local efforts can be related to national and international efforts,, thus fostering the credibility and recognition needed while, at the same time, providing the data necessary for local-level action.

Finding a means to balance *cost* and *accuracy* and avoid the potential trade–offs between *action* and *comparability* is an important issue to take into consideration in discussing the harmonization of methodological approaches.

3.3.2. Flexibility and Harmonization

Ensuring that a harmonized methodological approach can remain flexible for a range of applications requires that a number of basic definitions be established for all information tools. Once established, different uses (operational vs. territorial emissions; direct–emission inventories vs. life-cycle analysis) can contextualized methods based on a common framework to specific uses. This is often necessary not only to adjust methods to data constraints and availability, but also to sectoral needs as described above. While a small body of literature exists on this subject, it has looked principally at the harmonization of approaches for territorial or operational inventories with less recognition that a variety of different approaches may be necessary (Ibrahim et al. 2012; Kennedy et al. 2010; Ramaswami et al 2008; Kennedy and Mohareb 2009).

Table 57: Harmonization of Methodological Choices

	Harmonization of Definitions Essential	Coherence Across Uses Recommended
Calculation & Definitions	- Definition of perimeter (operational, jurisdictional competencies, territorial) - Definition of sectors - Responsibility for emissions (control [financial or operational] and equity share) - Scopes	- Perimeter used - GHG gases included - Scopes included - Frequency - Data (statistic vs. consumption based) - Emission factors - Level of precision / accuracy / detail
Reporting	- Transparent inclusion of activity data and emission factors - Standardized reporting format using harmonized definitions of sectors - Definitions used and separate accounting of Scopes	
Uncertainty	- Estimation of inherent uncertainty concerning data quality due to emission factors, data sources, methodological choices taken, etc.	
Consistency	- Information tools adopt consistent methods across time to ensure comparison	

Source: Author after Ibrahim et al 2012; Kennedy et al 2010; Cochran 2010; WRI/WBCSD 2004

As seen in Table 57, it appears that the harmonization of different methodological choices can be grouped together as either essential or recommended. First, a number of definitions must be harmonized across uses. These include how the perimeter of GHG inventories and other tools is defined, whether based on operational boundaries, along jurisdictional competencies or at the level of a given territory. Second, a common definition of what is included in different sectors should be established. This is a key definition for aggregating emissions for presentation and reporting. As seen in Table 58, it is important that these categories be contextualized for local actors, corresponding to their operational activities, in this case the adapting of IPCC guidelines and definitions to local-scale uses. Third, it is important to harmonize how responsibility is assigned to entities for GHG emissions when service provision or activities are delegated to a second actor. While a full review is beyond the scope of this chapter, the World Resources Institute / World Business Council on Sustainable Development (WRI/WBCSD 2004) has indentified three principal methods for linking responsibility at the corporate level: financial control, operational control and equity share[124]. While each definition has its advantages and limitations, it is more

[124] When operational criteria are taken into consideration, a control-based approach indicates that entities are responsible only for those emissions over which they have direct control. Thus, the local authority would be responsible for 100% of the GHG emissions from a contracted service provider (e.g. transport services) over

important that one definition be established and applied homogeneously across information tools. Finally, it is important that a common definition of how direct, indirect and upstream emissions is included. As such, common definitions of what enters into each scope as established by the WRI/WBCSD (2004) and adopted by the International Standard Organization (ISO 2006) should be adopted.

Table 58 : Example of Disaggregated Local Reporting Framework - ICLEI International Local Governments GHG Emissions Analysis Protocol

Macro Sector (IPCC)		Government Sector (ICLEI)
Energy	Stationary Combustion	Buildings and Facilities
		Street Lights and Traffic Signals
		Water/Sewer (energy only)
	Mobile Combustion	Vehicle Fleet
		Employee Commute
	Fugitive emissions	Other
Industrial Processes and Product Use		Other
Agriculture, Forestry and Other Land Use		Other
Waste	Solid Waste Disposal	Waste
	Biological Treatment of Solid Waste	
	Incineration and Open Burning of Waste	
	Wastewater Treatment and Discharge	

Source: ICLEI 2009

There is also a need for the introduction of coherence across uses. While dependent on the specific context within which the information tool will be used, it is important to establish general guidelines for a number of parameters. First, this includes the perimeter used, the GHG gases included, and which scopes are included, among other factors. Second, it also includes how quantification occurs in practice, such as frequency (annual, bi-annual, etc.), what data is used (statistic downscaling vs. consumption based), emission–factor choices, as well as the desired level of precision and detail of the results. These choices, including the activity data and emission factors used, should be clearly indicated for transparency purposes in the final reports. While a number of these issues appear evident, the issue of accuracy is more difficult to define. The WRI/WBCSD defines accuracy in terms of GHG inventories to:

> Ensure that the quantification of GHG emissions is systematically neither over nor under actual emissions, as far as can be judged, and that uncertainties are reduced as far as practicable. Achieve sufficient accuracy to enable users to make decisions with reasonable assurance as to the integrity of the reported information.

As such, the level of detail needed for types of information tools can be linked to the decision-making process and what level of precision in terms of quantifying emissions is

which they can require mitigation efforts (i.e. technology changes, etc.). In the case of financial control, responsibility is equally shared in the financing of an operation resulting in GHG emissions. However, if the entities do not have this direct operational or financial control, they are responsible for 0% of emissions. An equity-based approach considers the equity share of a given entity (e.g. publicly owned energy production), where the percentage of responsibility for emissions corresponds to the percentage of equity share; thus, for example, 40% of emissions for a 40% equity stake.

salient.

As seen in Chapters 4 and 5, the level of detail necessary can vary depending on whether the measure is designed to identify the principal sources of emissions (less detail) to linking emission reductions to financing, such as domestic offset projects or other market–based mechanisms (more detail). Information concerning the accuracy of results can be communicated through an estimate of the *uncertainty* of results, which should be included in the final reporting of the inventory or information tool. While uncertainty can be linked to climate sciences and any modeling tools in producing the expertise, estimating this may be beyond most inventory efforts (WRI/WBCSD 2004). The IPCC has developed a three-tiered approach to evaluate the uncertainty of data to characterize the accuracy of results. Tier 1 data and methods is the most accurate, based on measured activity data. Tier 3 results are the most uncertain, based on top-down, down-scaled statistical analysis. Tier 2 results typically mix both Tier 1 and Tier 2 data (IPCC 2004). Thus, a reporting of uncertainty should be based principally on a quantitative or qualitative evaluation of the quality of activity data, emission factors, etc. used.[125]

3.3.3. Addressing Barriers, Establishing Incentives

There are a number of barriers that exist to slow progress towards harmonization of urban methodologies and suggest the need for incentives to move in this direction. One important set of barriers exists at an organizational level. It can be legitimately argued that each approach often responds to a niche demand or decision-making process. While different approaches share often a number of methodological elements, given that little overlap between these different niches exists and the current lack of an incentive to harmonize, it is not surprising that harmonization has not occurred.

A number of obstacles to harmonization also exist at the local level. Local authorities may oppose the deployment of an obligatory standard because it could be perceived as a means for the central government to exercise more control over their operations. In particular, local authorities may perceive a harmonized methodological framework as being only of use to national authorities to collect data, rather than as a tool for local-level action. As such, harmonization should be flexible enough to be adaptable to produce numbers useful to both local and national mitigation efforts. Also, with the increasing recognition of the immensity of the task for some national governments to meet increasingly ambitious climate goals, local authorities may fear that a harmonized inventory system is a step towards imposition by national governments of binding local–emission reduction targets. If these targets came without the provision of additional resources, local governments would potentially be constrained in decisions about how to use already “thin” local finances across a growing number of urban policy objectives.

[125] For example, the Greenhouse Gas Regional Inventory Protocol (GRIP) developed by Tyndall Centre

for Climate Change Research, University of Manchester and UK Environmental Agency (Carney et al. 2009) used by the European Network of Metropolitan Regions and Areas (METREX) has established a color-coded system of estimating data quality.

Local authorities may also be uncomfortable with the notion of comparisons or standardized performance assessment across regions. They may fear that such data could result in negative comparisons between themselves and other areas, given that the potential for emissions reduction and emission intensities vary contextually. For example, it would be inappropriate to compare emissions from an urban region with energy-intensive, heavy industry to another urban region with an economy based largely in the service sector. Finally, a number of local governments have already actively deployed methodologies and quantification tools for their own use and these may be embedded in their efforts to manage emissions. The prospect of shifting to a different methodology or using a different tool may be expensive and disruptive, particularly when no technical or financial resources are provided to aide in the transition.

These barriers present a relatively complex challenge to harmonization. To date and in the near future, most local–level action on GHG mitigation has remained voluntary and, thus, a top-down mandating of a single accepted methodology is, in most cases, unfeasible. However, harmonization and the adoption of a *de facto* standard could advance quickly were there a "carrot" or an incentive to be developed for all the actors involved. It would also be important to address the future "demand" for the protocol among various actors–whether they are national governments or development banks – in order to ensure that local authorities have the proper incentives to adopt it willingly, and, thus, achieve its rapid deployment. Finally, it would be valuable to create a forum or an appropriate institutional mechanism through which harmonization could occur.

3.4. State of Practice in France

While little information is available to date concerning how greenhouse-gas mitigation information and criteria are being integrated into sectoral decision-making processes, it is possible to see which methodologies are being used within the framework of climate action plans. The data on methodologies used to evaluate GHG emissions within the framework of their climate action plan by the 217 self-reporting local authorities to the *Observatoire des PCET*[126] created and maintained by the ADEME, can be used to identify the state of current practice in France[127]. Of the 217 self-reporting authorities, 79 had reported creating an inventory of operational emissions. Of these 95% (75) reported using the *Bilan Carbone® patrimoine et services* methodologies initially developed by the ADEME. Just 6% (5) of the actors reported using other methodologies, including what appears to be internally developed methodologies as well as regional methods (*Ener'GES* in Brittany). Methodological approaches, however, were more varied in terms of the quantification of territorial methods. Of the 217, 152, or 70% of authorities, had conducted territorial emissions, in general using one of two principal methods. First, approximately 40% (65) of authorities reported using the *Bilan Carbone® territoire* methodology developed by the ADEME. Second, approximately

[126] http://observatoire.pcet-ademe.fr/ Accessed 20 March 2012

[127] While over 400 PCET appear to be in progress in France, only a little over 200 have self-reported their state of progress to the ADEME.

30% (45) of authorities used a different approach, basing their approach on the cadastral direct-emission information available from the regional AASQA initially collected for local air quality monitoring. Further, approximately 10% (16) of authorities combined the two approaches in order to produce the territorial inventory. As will be discussed below, the distribution of the methodology used for territorial inventories appears to be linked to the *région* within which the authority is located.

Table 59: Breakdown of GHG Quantification by Methodology in France

Operational Emissions *(80 of 217 reporting)*		**Territorial Emissions** *(152 of 217 reporting)*				
Bilan Carbone® patrimoine et services	*Other (internally developed / Ener'GES)*	*Bilan Carbone® territoire*	*Cadastral Territorial Emissions (AASQA)*	*Combination of Bilan Carbone® / Direct Territorial*	*Other (internally developed / Ener'GES)*	*Unknown*
95% (75)	6% (5)	43% (65)	30% (45)	11% (16)	5% (9)	11% (17)

Source: Author using data from ADEME 2012

While convergence appears to be occurring around a handful of methodological tools, it is important to note that these different tools can have significantly different results. A recent (2011) CERTU study of approximately 40 urban areas in France indicates that 25 had completed GHG inventories at the territorial level.[128] As seen in Table 60, with access to individual results, this study confirms that given the life-cycle approach used in the *Bilan Carbone®*, it is not surprising that GHG emission totals tended to be, in general, higher for those urban areas using this method. As such, per–capita emissions are estimated higher with the *Bilan Carbone®* approach, but still less than national averages. Further, their analysis indicates that it is not possible to aggregate the results of the different inventories in order to understand how urban authorities are contributing to France's 2020 energy and climate targets (20, 20, 20). Nevertheless, the results are being used internally by the local governments to structure their climate policy and to track progress (CERTU 2011).

Table 60: Differences in Per–Capita Emissions by Methodology Compared to National Average in France

	Per–capita emissions
Bilan Carbone® ADEME	5 à 11.6 tCO2e/inhabitant
la méthode cadastrale	4.7 à 7.3 tCO2e/inhabitant
National average	8.2 tCO2e/inhabitant

Source: CERTU 2010:23

3.5. Towards Harmonization: Grenelle II Obligations and Inventories of Operational Emissions

As stipulated by the *Grenelle II* legislation in 2010, the French State has developed

[128] This study equally confirms the tendency towards a handful of different methodological approaches. In their study, the CERTU found three principal methodologies used, notably the *Bilan Carbone®* ADEME (*territoire et patrimoine et services*), the AASQA direct–emissions inventory methodology as well as the *Ener'Ges* tool developed by the State, the Brittany Region and the ADEME.

methodological guidelines for use in statutory GHG inventories. Article 75 requires that an inventory of operational emissions be produced by the State, *régions, départements*, as well as local governments of all types with more than 50,000 inhabitants, as well as private companies with more than 250 employees. These inventories are required to quantify greenhouse gas emissions linked to the internal, operational activities of the given actor. Based on international standards (principally the Norm ISO 14064[129]), two methodological guides have been produced: the first outlining the principal operational procedures to follow, as well as the specificities for private companies. The second looks specifically at the case of local authorities (*collectivités*) for whom responsibility for emissions stems from jurisdictional competencies. The results of the first GHG inventory for all actors must be submitted by 31 December 2012.

The national guidelines set a framework for accounting, identifying what must be included, but does not necessarily indicate how the calculation itself should be made. As such, including GHG emissions from operational emissions is obligatory; however, in the case of local governments, territorial emissions are optional. Nevertheless, as seen by the state of practice in France, many actors have already taken partial responsibility for this. As seen in Table 61, definitions have been established for a number of the key methodological choices for the development of inventories. A number of elements have been clearly defined, such as the GHG gases (six gases recognized by the Kyoto Protocol) and scopes to include (1 and 2), the frequency, definition of sectors for reporting and the attribution of responsibility for emissions. However, a number of elements have been defined but are flexible to be defined by choices on a case-by-case basis. This includes the emission factors and types of data to be used, as well as the definition of a reference year. While the guidelines follow the Norm ISO 14064 to select methods that will reduce uncertainty and result in precise, coherent and reproducible results, differences in application may be substantial. Finally, little clear indication is given in terms of how to evaluate the uncertainty of the data, indicating that any comparison of uncertainty across inventories will be difficult.

It is also important to look at the reporting format for the required GHG inventory. While a harmonized approach has been established, there appear to be a number of shortcomings that may reduce the saliency of the information produced for local authorities. The reporting format is clear in requiring actors to report on the perimeter, emission factors (if different from those established by the ADEME nationally) and the reference year. However, it does not require the reporting of the raw data, nor details on how the data itself was calculated (statistic, modeled, or measured). Further, the reporting format for the resulting emission totals itself does not, as show above in Table 58, break emission into categories that correspond to operational considerations. Currently, the guide requests that emission be reported in terms of direct (combustion, motors, industrial processes, fugitive emissions, biomass,) and indirect (electricity consumption, consumption of steam, heat, cooling) sources. However, it may be more useful if the reporting format divided results into operational categories, such as building and facilities, street lights and traffic signals, water/sewer

[129] Standard on the quantification of greenhouse gas emissions established by the International Organisation for Standardization.

(energy), vehicle fleet, and waste disposal and treatment. As such, the concrete actions to reduce emissions can be identified more easily.

Table 61: Official Methodological Guidelines for GHG Inventories in France

Scopes	Required: Scopes 1, 2 Optional: Scope 3
Perimeter	***A minima*:** Local Authorities: Organizational approach (required) - Buildings and facilities - Jurisdictional competences
Frequency	Every three years
Reference year	Up to each actor, but before 1999
Definition of sectors	Emission sources as established by the Norm ISO 14064 - *However, no key for breaking them into sectors*
Responsibility for emissions	Local authorities must include emissions from sub-contractors, mandated bodies and other actors involved in the concession of public services to second parties *Article 4.4–if the competency has been transferred to an inter–communal structure, it is the inter–communal structure that is responsible for reporting it in their inventory*
GHG gases	Six Kyoto Greenhouse Gases: CO_2, N_2O, CH_4, SF_6 (sulphur hexafluoride), HFCs (hydofluorocarbons) and PFCs (perfluorocarbons).
Emission factors	Case by case: restrained to territorial, national or internationally established emission factors
Data (statistic vs. consumption based)	Case by case : data can either be established by statistical calculation or physical measurement
Level of precision / accuracy / detail	The entity producing the inventory must provide information concerning the uncertainty on the principal emission sources included. These elements can be either qualitative or quantitative.

Source: After MEDDTL 2011a, 2011b

While these guidelines represent a first step towards harmonization, their perimeter remains limited to only the operational emissions of local authorities. However, given the above analysis of the current state of practice in France, local authorities tend to produce more detailed inventories already using the *Bilan Carbone®* approach. Nevertheless, these guidelines take steps to set the minimum definitions while a number of improvements – particularly in terms of sectoral definitions and reporting – should occur. If the national objective is to achieve a level of harmonization that excludes double counting where the sum of sub-national inventories equals the national total, much more effort is required. However, if the objective is to establish a set of basic definitions to facilitate exchanges across and among levels, then these guidelines have taken the necessary initial steps.

3.6. Section Conclusions

The increasing number of information tools being developed to reduce greenhouse gas emissions across levels poses the question of the harmonization of methodological approaches. While harmonization appears necessary to a certain degree, it is equally important to recognize the need for the contextualization of methodological approaches in order to ensure the continued saliency of the information and expertise produced. Different approaches will continue to be necessary. In general, although the range of quantification approaches are similar, it is important to address the need for consistent, transparent and–when possible–comparable results requires looking into the details of how quantification occurs. As such, harmonization requires a common agreement, both in terms of the technical choices made in calculation (gases, data sources, emission factors, etc.), as well as the normative issues in terms of setting the perimeter for analysis and the assigning of responsibility for emissions.

Achieving harmonization appears, thus, to be subject to two trade-offs. First, a trade-off between *cost* and *accuracy*. Second, a trade-off between *action* and *comparability* is apparent in different demands resulting from internal and external uses. As such, any harmonization of methods must be flexible enough to allow individual local authorities to produce information suited to their needs. Assuring flexibility as well as a harmonized approach appears to require definitions for a set of common methodological parameters, while allowing a second set to vary among applications. As such, definitions need to be established to create a common understanding of perimeter (operational, jurisdictional competencies, territorial), sectors, responsibility for emissions, as well as what is included in each emission scope.

This section has looked at what methodological issues need to be considered in terms of harmonization to ensure the credibility of the information produced for decision making. The following section will address the remaining questions concerning how the information – production process should be structured to ensure the legitimacy of the expertise.

4. PRODUCING LEGITIMATE AND CREDIBLE INVENTORIES: INTERNAL COMPETENCIES AND LONG–TERM EXTERNAL PARTNERSHIPS

As explored in Chapter 1 and as seen above, the value of the information is not only in its technical exactness, but also in how it is integrated into the larger decision-making process. Often, the idea is that with "more" and "better" information, actors will be able to produce "better" and more "informed" decisions. However, as Tribbia and Moser have identified, more and better information will not necessarily lead to "better" decisions:

> "Many environmental policy initiatives fall short of expectations because experts simply believe that 'better science will lead to better decisions' without fully understanding the decision situation and institutional context within which scientific information could be used… or what a decision-maker could really use" (Tribbia & Moser 2008:317).

The development of a general culture around greenhouse gas mitigation appears linked not only to the existence of mitigation objectives and inventories, but also the production process itself. As such, the idea of the co-construction of expert information with the full range of actors was often raised by interviewees. This "opening-up" in terms of participation in the production of expertise and of the policy-process (Corfee-Morlot 2009) can, however, conflict with the need to produce a "simplified" response to a specific, pressing policy problem. As such, it appears that it is necessary to analyze not only how information is used, but also how the information is produced.

For a number of actors, the value of the GHG inventory within the GHG mitigation process went beyond that of a "number," becoming, rather, a means of starting a dialogue among actor groups (Huré 10.12.08; Filhol 10.20.17). The development of a common “language” with which GHG mitigation efforts can be planned and discussed has helped many actors to understand their role in achieving emission reduction objectives (Buffière 10.10.19; Filhol 10.10.19; Poimboeuf 10.10.21; Uhry 10.10.20) better. An important component of appropriation has been the contextualization of the different measures to specific sectors through a continual dialogue; that is, identifying the most appropriate unit of measurement and educating actors to what it measures specifically, as well as how it can be used to influence action (Huré 10.12.08). As such, it is important to look at the processes and partnerships that have been put into place to coordinate the production and use of expertise and information on greenhouse gas inventories.

4.1. Information Production as a Dynamic System among Actors

As discussed in Chapter 1, a number of researchers have framed the production of information and expertise as a “system” rather than a one-way transmission of information from scientists to decision makers who are expected to use it to make better decisions (Cash et al. 2003; Tribbia & Moser 2008; Corfee-Morlot et al. 2010). Within such a system, exchanges between the expert or scientific community and decision makers foster the “co-production” of knowledge, which is viewed as salient, credible and legitimate for all parties involved (Tribbia & Moser 2008). Finding an institutional form to foster an iterative exchange among scientist, experts and decision makers, however, may not be an easy task. A number of researchers (Cash et al., 2003; Guston, 2001; Gieryn, 1999; Tribbia & Moser 2008; Corfee-Morlot et al. 2010) have suggested that “*boundary organizations”* “…can help improve the end-to-end process of knowledge co-production and application by enabling scientists and decision-makers to increase mutual understanding of capacities and needs while remaining within their respective professional boundaries” (Tribbia & Moser 2008:317). Boundary organizations are agencies or entities that “…have the overall dual purpose of protecting but also transcending the divide between science and practice (e.g., protection from the politicization of science, transcending for improved information flow) (Tribbia & Moser 2008:317). As such, they are able to treat the concerns related to the politicization of information and indicators raised above, but also the salience, credibility and legitimacy of the information produced.

Boundary organizations serve two principal purposes in the co–production of information and knowledge. First, they facilitate collaboration between experts and decision makers on different subjects. Second, they are able to produce what have been termed as “boundary objects” or “…information and things used by both scientists as well as by politicians for different objectives, but without compromising the things themselves” (Guston 2001:401). To achieve these objectives in the production of expertise, the literature suggests that boundary organizations fulfill a number of functions: *convening, translating, collaboration and mediation* (Tribbia & Moser 2008; Guston 2001; Corfee-Morlot et al. 2010). First, boundary organizations have a *convening function* to bring the different stakeholders together on the issue. Second, as mentioned above, the organization works to *translate* the subject being treated into terms that the different parties are able to understand and then discuss. Third, the boundary organization facilitates an ongoing *collaboration* process, involving frank and transparent exchanges, to co-produce "relevant and scientifically credible, applied knowledge" (Tribbia & Moser 2008:317). Finally, these organizations play a *mediating* role to ensure the fair representation of the different stakeholder parties involved.

In the case of climate change mitigation, greenhouse gas information tools appear to be a clear example of a co-produced boundary object that is useful both to the scientific community as well as to decision makers. However, in the climate change literature to date, boundary organizations have principally been applied to the context surrounding adaptation to a changing climate (Vogel et al. 2007; Tribbia & Moser 2008; Corfee-Morlot et al 2010). These principals, nevertheless, appear relevant for questions related to greenhouse gas mitigation. The formal and information institutional arrangement and processes surrounding the production of these tools can influence their legitimacy, credibility and saliency. The question of legitimacy is particularly important as the process and the actors involved in the development of the information can influence whether it is perceived as biased or acceptable to different actor groups.

As analyzed in the above section, there has been the development of both a number of information tools as well as steps towards harmonizing approaches, at least in terms of GHG inventories. However, it is necessary to characterize better the process of appropriation both of the national or harmonized inventories and standards by actors in the production process, as well as the resulting expertise and information by decisions makers. As such, the following section will first look at the role of boundary organizations and the internationalization of quantification capacities within local authorities. Second, the different partnerships among local governments and technical bodies will be examined to understand their impact on the production and legitimacy of information better.

4.2. Negotiating the Boundary between Expertise and Decision-Making: Development of Permanent Internal Competencies

The appropriation of expertise and information on greenhouse gas emissions into policy processes requires the translation of expert knowledge into a form that is understandable for policy makers and framed in a manner to be relevant to decision making. This requires introducing new criteria to the multiple actor groups with different priorities and policy frames (see Chapters 3, 4 and 5). Further, given the transversal nature of greenhouse gas mitigation that cuts across multiple sectors and levels of organization, the development of a new "language" to discuss existing issues is required. Recognition that the appropriation of both climate change as a policy subject and a new "language" to discuss GHG emissions is a long-term process measured in years (Mallet 10.12.08) has led to the development of an internal institutional capacity for GHG quantification in both cases. As seen below, both Grenoble Alpes and Nantes Métropoles have developed an institutional capacity to internalize the production of GHG expertise, often through dedicated staff positions. This internationalization appears to foster the co-production of information where agencies and permanent staff work with both elected officials and external technical experts in the production of information. These agencies and staff appear to play many of the same roles as boundary organizations as described in the literature, negotiating between the political and the technical to foster the appropriation of expert information on GHG mitigation.

4.2.1. Development of Internal Capacity to Manage Expertise

Grenoble Alpes Métropole and Nantes Métropole both initially worked with an external technical consultancy (*Explicit*) when developing their first GHG inventory. Nevertheless, since then, both inter–communal structures have worked to internalize the capacity to manage the production of GHG information tools. While the development of internal capacity has taken different forms in the two cases, both have attempted to reduce the perceived limitations of working with external consultations to foster long-term appropriation and continuity. These limits include not only full access to the methodological approaches and data produced, but also the assurance of annual tracking of emissions. To date, this has been principally limited to the development of GHG inventories used in the larger climate action plan process. However, in recent years the different "boundary" actors have been involved in developing sectoral information tools.

Grenoble Alpes Métropole: the Observatoire du Plan Climat et l'ALEc

To coordinate the production of the territorial inventory, Grenoble Alpes Métropole has created a GHG-analysis unit entitled the *Observatoire du Plan Climat* based within the *Agence Locale d'Energie et du Climat*[130] (ALEc). Rather than working each year with an external consultant to conduct the inventory, *La Métro* has chosen to develop the capacity internally (Poimboeuf 10.03.01). Created in 2004, the *Observatoire du Plan Climat* is a partnership among *La Métro*, the ASCOPARG (*Association pour le contrôle et la préservation de l'air en région Grenobloise*) and the ALEc (Agence Locale d'Energie et du Climat). The principal objective of the observatory is to work with the ASCOPARG and other technical bodies to assist with the larger dynamic (see Chapter 4) and evaluation of the inter-communal structure's climate action plan. As such, the observatory tracks not only the energy consumption and greenhouse gas emissions from the territory and the operations of the *communauté d'agglomération*, but also analyzes the percentage of renewable energy and works with individual *communes* in analyzing energy consumption and emissions. These results are presented to the full range of actors involved in the climate action plan processes during the twice-yearly forum and used to define and modify objectives. As such, they are able to foster the long-term appropriation of the GHG expertise by both technical staff as well as elected officials. Further, they have developed methodological tools tailored to the needs and data availability of the *communauté d'agglomération*.

The permanent embedding of the observatory into the ALEc structure has allowed it to profit from the perceived neutral role of the *Agence Locale d'Energie et du Climat*. Given the relatively recent creation of Grenoble Alpes Métropole and the continued political tension between individual *communes* and the intervention of the inter–communal structure, the use of a third–party agency allows a partial depoliticizing of relationships (Uhry 10.10.20; Filhol 10.10.17). Given its independence as an agency, in many instances ALEc is seen as a legitimate and politically neutral actor, allowing it to intervene across administrative and

[130] See Chapter 4 for a broader description of this agency's role in the climate action plan.

political boundaries within the inter–communal structure. *La Métro* would potentially have difficulties interfacing directly, given political tensions between the inter–communal structure and the individual *communes* (Uhry 10.10.20). Equally, the observatory has been able to use the four ALEc colleges of members and partners[131] to work directly with private sector and non-governmental actors. As such, the observatory is in a position to interface among a large range of public and private actors both across the *communauté d'agglomération* as well as at the regional and national level. For example, the ALEc and the observatory were consulted and played an initial role in the framing of the SCOT CO_2 study conducted to evaluate the impact of the proposed SCOT on GHG emissions in the greater urban area (Filhol 10.10.17).

Nantes Métropole: Services Animation Développent Durable et Climat

Initially, Nantes Métropole worked closely with external consultants in developing their GHG accounting at the territorial level. Given that this work began in the mid-2000s before a large number of methodologies were available, the assistance from an external consultant was essential in providing a foundation for quantification (Guillard 10.02.17). However, it became clear that the annual tracking of emissions or a continual evaluation of the progress of the climate action process required transparency concerning the quantification methods used as well as access to the data used. Noting a lack of access to, appropriation and long-term coherence of the different methodologies deployed by external consultants, the C.U. has acted on a desire to establish an internal capacity on this subject (Guillard 10.02.17; Huré 10.12.08). As such, the creation of the larger *Services Animation Development Durable et Climat* included a staff position charged with the quantification of GHG emissions.

Recognizing that inventories and associated technical capacities are necessary for managing a complex, intangible pollutant such as greenhouse gas emissions, the *communauté urbaine* has begun to develop the competencies to go from "data to action" (Mallet 10.12.09; Huré 10.12.08; Guillard 10.12.147). The *Service Animation* has focused on developing a culture of carbon and GHG quantification throughout the different departments and divisions within the *communauté urbaine*.[132] As such, they have worked transversally in developing a number of informational tools, such as the *100 Actions* quantification and various life-cycle analysis of departments and projects (see Chapter 4 and Annex 6 for more details). An important and stated part of this work with the individual departments, as well as with elected officials, has been to foster the acculturation to GHG mitigation as along with the

[131] The ALEc is made up of four colleges of members. College A is made up of the *communauté d'agglomération* and the 27 *communes*, as well as the *Syndicat Mixte de Transports en Commun* and the *conseil general de l'Isère*. College B is made up of actors from the private sector, *including La Compagnie de Chauffage, EDF, GDF Suez, Gaz Electricité de Grenoble* and *Isergie*. College C is composed of public, private and non-governmental associations, including universities and social housing authorities, active in the field of energy. Finally, College D is made up of association national and regional members, including the *ADEME*, and the *ASCOPARG*. (ALEc 2012)

[132] It is important to note the Nantes Métropole, as a *communauté urbaine*, has more unified control over a wider range of policy subjects than Grenoble Alpes Métropole as a *communauté d'agglomération.* This includes the direct intervention with the individual *communes*. Further, to date, the structure of Nantes Métropole's climate action plan and processes has focused less on engaging the private and non-governmental sector, and focusing more on internal actions.

appropriation of decision-making tools (Mallet 10.12.09; Gouriten 10.12.08; Huré 10.12.08). In some instances, external consultancies are still called upon to produce the needed expertise (particularly in the case of life-cycle analysis at the project level); however, the *Service Animation* plays an important role in assuring coherence as well as appropriation of results (Gouriten 10.12.08; Huré 10.12.08). Further, it has played a role in the development of sector-specific information tools, such as the GHG analysis of the 2010-2015 PDU scenarios (Huré 10.12.08; Ranty 10.12.07).

4.2.2. Functioning as Boundary Organizations?

The institutional arrangements described above do not correspond completely to the definition of boundary organizations as found in the literature. In both cases, the *Observatoire du plan climat* within the larger ALEc, as well as the *Service Animation*, are both involved in the formulation and implementation of policies and programs. Further, rather than separate agencies or organizations, it is a single *actor* integrated within larger structures. Nevertheless, these individual staff members appear to fulfill many of the same functions in the production and appropriation of GHG information and expertise. While they may not be completely independent "agencies," they both appear to play an important role in arbitrating between expert and policy–making worlds.

As seen in Table 62, in both cases the identified "boundary actors" play a role in convening and communicating with a wide range of actors, often through existing processes established through the larger climate action plan process. In both Grenoble Alpes and Nantes Métropoles, they bring together elected officials, the different departments and divisions of the inter–communal structures, actors from individual *communes*, as well as experts from universities, technical bodies and consultancy companies. This tends to occur through existing mechanisms and structures, whether the *Forum Climat*, which brings together a wide range of actors around the climate action plan process or through the different advisory councils that exist, such as the specialized climate scientific councils (*Conseil Scientifique du Plan Climat*) or the existing development councils (*Conseil développement*).[133]

Further, whether information tools are developed internally or externally, boundary actors play an important role in translating the needs of departments and political actors as well as the inputs of expert groups. In the case of Grenoble, the *Observatoire du plan climat* has worked with the *communauté d'agglomération* and technical bodies, such as the ASCOPARG, to develop a territorial inventory adapted to the needs of the C.A. in terms of annual evaluation progress as well as the data constraints. In Nantes Métropole, the quantification staff member in the *Services Animation* is working to re-appropriate and harmonize the methodological approaches taken in the past by consultants and work with the *Air Pays de la Loire*, the local AASQA, in developing a territorial approach to monitor emission annually. Further, both *boundary actors* also appear to play a role in the development of methodologies tailored to specific departments, projects and policies. This has

[133] The *Conseil de développement* are standing advisory bodies that bring together a large number of social and economic actors to discuss the larger strategy or *project du territoire* as defined by the 1999 *Loi d'Orientation pour l'Aménagement et le Développement Durable du Territoire*.

been seen particularly in Nantes through the development of the quantification of individual public policies (*100 Actions*), as well as the life-cycle analysis of individual departments.

Table 62: Boundary Functions and Actors in Grenoble Alpes and Nantes Métropoles

Boundary Functions	**Grenoble Alpes Métropole:** ***Observatoire du Plan Climat / ALEC***	**Nantes Métropole:** ***Services Animation Développent Durable et Climat***
Convening & Communication	*Bring together:* - Elected officials - Departments of the *communauté d'agglomération* - *Communes* - Private signatories of *chartre d'engagements* - Regional, *départemental* and NGO actors - Residents - Experts: university and technical bodies–ASCOPARG, consultants *Through participation in:* - *Forum Climat* - Scientific council - *Conseil de développement* - Development of sectoral tools (PDU / SCOT)	*Bring together:* - Elected officials - Departments of the *communauté urbaine* - *Communes* - Experts: universities and technical bodies–*Air Pays de la Loire*, consultants *Through participation in:* - *Forum Climat* - Scientific Council - *Conseil de développement* - Development of sectoral and department/program specific information tools
Translation	- Development of customized methodology for needs of and data constraints of C.A. - Needs of C.A. and individual projects to external consultants (life-cycle analysis) - Expertise from ASCOPARG, consumption data	- Re-appropriation of methods and harmonization of approach - Works with individual departments to produce the needed information (*100 Actions*, life-cycle evaluation of services, PDU scenarios analysis) - Expertise and data from *Air Pays de la Loire*, consumption data
Mediation	ALEc seen as a politically neutral actor - Mediate among private actors, *communes* and the inter–communal structure	Less effective as perceived as part of the inter–communal structure

It appears that, at least in the case of Grenoble Alpes Métropole, there is a measure of neutrality given to the *Observatoire* by its position within the larger *Agence Locale d'Energie et du Climat* structure. Nevertheless, further research appears necessary to understand fully the role of these *boundary actors* in the mediation among stakeholders and political and technical actors.

4.3. Fostering Lasting Partnerships with Technical and Expert Bodies

A seemingly equally important part of the GHG information tool development process appears to revolve around the construction of long-term partnerships with technical and expert bodies. While boundary organizations are in a position to interface between experts and policy-makers, Tribbia and Moser (2008:323) have pointed to the importance of "trusted information providers and sources." In France, the two cases studied here indicate that the *Associations agréées de surveillance de la qualité de l'air* (AASQAs) are key in providing technical expertise and data. As seen in Box 6, the AASQAs have played an important role in monitoring local air quality and working with the full range of stakeholders involved, including national and local authorities, as well as private companies and non-governmental associations. In many instance, they have developed models and datasets often encompassing both natural as well as anthropogenic emissions of air pollutants. In many cases, local authorities have built upon both the existing relationships as well as existing datasets to equally work with the AASQAs on greenhouse gas emission monitoring and mitigation.

Box 6: ***Les AASQAs - Associations agréées de surveillance de la qualité de l'air***

The *Associations agréées de surveillance de la qualité de l'air* or AASQAs are non-profit associations recognized and approved by the French Ministry of the Environment to monitor and report on air quality issues officially. Since the 1996 law on air quality and the rational use of energy (LAURE), these organizations are charged with monitoring air quality, disseminating results and forecasts, as well as notifying State representatives at the *prefecture* level in case of local violation of air quality standards and regulations. In many cases, individual AASQAs have developed sophisticated and detailed models to estimate emissions for the majority of air pollutants across their jurisdictions.

Together, the 38 AASQAs typically operating at the level of one of the 26 regions in France that make up the national *Fédération Atmo*. The board of directors of each AASQA is made up of four different "colleges" regrouping a broad range of actors from different levels of government and sectors. The first college is made up of representatives of the State and different decentralized services (*Prefecture*, *DREAL*[134], *ADEME*, regional health agencies, etc.). The second college is made up of representatives from sub-national authorities (regional and departmental councils, inter–communal structures, *communes*). The third is made up of major emitters of air pollution (local chambers of commerce and industry, chambers of agriculture, industries, etc.). Finally, a fourth college is composed of qualified experts (health professionals, scientists, researchers, environmental organizations, consumer associations, associations of health representatives, other AASQAs, etc.). As such, each individual AASQA is able to federate a large portion of the key stakeholders involved in air quality issues–both in terms of regulation and prevention–as well as the emitters themselves and have the expertise that enables it to advise on the monitoring carried out. In theory, this balance aids each AASQA to ensure transparency and foster dialogue among groups.

Source: Fédération ATMO 2012

The development of a long-term partnership among inter–communal structures, boundary actors and the AASQAs can be clearly seen in the relationships among Grenoble Alpes Métropole, the ALEc and the ASCOPARG. The *Association agréée de surveillance de*

[134] Direction Régionale de l'Environnement, de l'Aménagement et du Logement

la qualité de l'air de la région grenobloise, or ASCOPARG, has been an important technical resource for local authorities on air quality issues since the mid 1970s[135] in the greater urban area. Historically working closely with the *Syndicat Mixte de transports en common* (SMTC) and the *Agence d'urbainsme de la région grenobloise* (AURG), the ASCOPARG has provided key data and modeling competencies, particularly on issues of transport-related emissions and urban development. Since the mid-2000s and the creation of the *Observatoire du PCET*, the ASCOPARG has equally provided key data used in calculating both energy consumption and greenhouse gas emissions at the level of the *communauté d'agglomération*. Pairing this data with locally gathered fuel and energy consumption information, the *Observatoire* has created its annual territorial GHG inventory methodology. Using the expertise of the ASCOPARG has allowed Grenoble Alpes Métropole to tailor a methodological approach and produce an annual estimation of emissions using a methodological coherence across the years. Given the public-services orientation of the ASCOPARG, its non-profit structure and the access to a rich dataset, the *Observatoire* is able to follow emissions with a frequency and level of precision that would not have been feasible (manpower, finance) if it were solely reliant on external consultants or internal data collection (Poimboeuf 10.03.01; Buffiere 10.10.19).

Further, while the methodology produced for use at the level of Grenoble Alpes Métropole has been contextualized, using available direct–activity data, the methodologies used to collect, estimate and model a significant portion of data used is coherent with the methodologies used by other actors across the Rhône-Alpes region. The participation of the ASCOPARG with the OREGES–*l'Observatoire Régional de l'Enérgie et des Gaz à Effet de Serre* operating at the level of the entire Rhône Alpes region, as well as other ASSQAs in the region[136] has ensured that a minimum of methodological harmonization has occurred (Poimboeuf 10.03.01). Rather than a top-down harmonization process from the State, this has occurred through a gradual process of combining modeling and quantifying resources at the level of the region to benefit all of the participating AASQAs.

Further, it appears that AASQAs and other regional-level technical bodies are equally playing an important role in other regions. An analysis of the data reported in the ADEME's *Observatoire des PCETs* (ADEME 2012) indicates the choices among methodologies being used by individual sub-national authorities (see Table 63). For example, in Alsace, where the ASPA (the regional AASQA) is a nationally recognized and respected technical body at the national level (Lavrilleux 10.12.09), all nine local authorities that have reportedly produced territorial GHG inventories have used a tool developed based on existing air–quality reporting tools. Although more information is needed, numbers from Franche-Comté and Champagne-Ardenne suggest that similar phenomena may be occurring. While this may be a result of existing centralized data, given the experience seen in Grenoble Alpes Métropole, it may also

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[135] The technical body which would become the ASCOPARG in the late 1990s was initially established in 1976. On January 1st, 2012, the ASCOPARG became part of the larger AASQA operating at the level of the entire Rhône-Alpes region, *Air Rhône-Alpes*, which it helped to create.

[136] There were historically six AASQAs in the Rhône-Alpes region which are now part of the Air Rhône-Alpes (six associations (*Air-APS, Ampasel, Ascoparg, Atmo Drôme-Ardèche, Coparly, Sup'Air*).

reflect the evolution of an established technical partnership around air–quality issues to include something new on climate.

Table 63: Territorial Methodological Distribution among Selected Regions and National Average

	Bilan Carbone®	ASQUA / cadastral	Other
Alsace	0% (0)	100% (6)	
Franche-Comté	0% (0)	75% (4)	
Rhône-Alpes	22% (4)	72% (13)	6% (1)
National Average	43% (65)	30% (45)	

Source: Author using data from ADEME 2012

Through established partnerships, it appears that AASQAs have an important role in assisting authorities to develop informational tools. While this study has focused principally on two middle- to large-sized urban authorities, partnerships with the AASQAs may be even more beneficial for small urban and rural authorities. It is likely that large urban authorities will have access to the resources to develop minimum GHG inventories and other information tools. However, as climate action plans and GHG inventories are produced by those actors in urban areas with less than 50,000 inhabitants, more assistance may be necessary. Currently, the AASQA *Air Pays de la Loire* is working with the regional office of the ADEME to establish a database of cadastral emissions at the level of the region with a resolution to the level of individual *communes*. This database on direct GHG emissions will serve as the basis for the ADEME to assist rural and small-level actors to have an idea of their emissions and identify the actions necessary to reduce them (Albert 10.12.09). Further, as mentioned above and in Chapter 4, *Air Pays de la Loire*, together with Nantes Métropole, is currently exploring how a more robust version of their database could be used to link territorial emissions with national or other performance-based finance.

While the cadastral-based methodology developed by the AASQAs may be limited only to direct Scope 1 emissions, the pairing of this with Scope 2 consumption and activity data, as has occurred in Grenoble Alpes Métropole, indicates that the potential to leverage an existing, detailed, and often trusted network of technical experts and data in the development of GHG information tools exists. Building a partnership over time with these technical bodies appears to further the legitimacy of the data produced, as well as potentially leverage a bottom-up harmonization of approaches.

4.4. Section Conclusions: Creating a Long-Term System for Production

As suggested by the literature, the production of the needed expertise and information tools for the management of greenhouse gas emissions appears to function more as a system. Rather than producing “more” or “better” information through a one-way flow from expert to decision maker, the production of information is the product of a dialogue among actor groups and the development of a common language. To foster the production of GHG expertise and information tools, both Grenoble Alpes Métropole and Nantes Métropole have sought to internalize the necessary competencies. In doing so, it appears that they have created what could be termed as “boundary actors” imbedded within the existing institutional arrangements. These actors fulfill many of the roles that “boundary organizations” ensure in the literature. While it appears that these boundary actors play an important role in fostering the development and appropriation of information tools, more research appears necessary, nevertheless, to understand the specific strategies used to mediate among stakeholders.

Second, both of the inter–communal structures have begun to foster lasting relationships with the local or regional AASQA (ASCOPARG in Grenoble, *Air Pays de la Loire* in Nantes) as well as a number of technical bodies at the regional level. These external partners typically play a key role in the provision of technical expertise, data and analysis needed to develop and maintain information tools and inventories. While further research is necessary, it appears that AASQAs and other regional-level technical bodies are also playing an important role in other regions (Alsace, Franch-Comté).

Given the above analysis of Grenoble Alpes and Nantes Métropole, the internalization of competencies through "boundary actors" and the development of long-term partnerships have an important role to play in the production of legitimate and credible information. These actors are key in the contextualization of GHG information to the needs of both regional and local stakeholders. As such, not only is the information produced perceived as legitimate and technically credible, but the overall saliency may be improved as the production of information becomes a dynamic process, rather and a one-way flow.

5. CONCLUSIONS

Building on the previous chapters, the above sections have explored how the appropriation and uptake of GHG expertise and information tools can be facilitated. Recognizing that information tools and the resulting "numbers" produced are important for policymaking, it has been equally necessary to look at how information is produced and the impacts on the uptake by actors. Applying theories treating the use of information and indicators in policymaking, their credibility, legitimacy and saliency, as well as how information production can influence its uptake and use, this chapter has attempted to glean a number of lessons from the French experience for general practice.

5.1. A Nascent Hierarchy among Information Tools

Expertise and information tools on greenhouse gas emissions play an important role in policy formulation, implementation and evaluation. Inventories and other "tools" aid in a number of decision-making processes including:

- *Diagnostic and baseline*–profile of GHG emission sources within the area of study to identify principal sources and understand evolution over time without intervention ;
- *Analysis of actions*–analysis of the direct and indirect impacts of emission reduction policies, often linked to analyzing their cost-efficiency in terms of cost per ton CO_2e;
- *Scenario analysis*–analysis and comparison of the direct and indirect mitigation of potential policy "packages";
- *Tracking progress*–deployment of periodic or punctual indicators to track progress towards emission reduction goals;
- *Ex-post evaluation*–analysis of actions taken and identification of their effectiveness.

In France, these different functions are being deployed in a number of policy processes including the larger management of climate action plans and the coordination of reduction actions, as well as the mainstreaming of GHG mitigation directly into individual policy streams. Most recently, a movement towards the development of performance-based financing tools incorporating a number of the different uses indicated above is being developed.

In the specific case of the integration of greenhouse gas emissions into transport and urban planning decisions, a hierarchy of tools focusing on the different strategic documents and actions begins to take shape. Three different levels can be identified, corresponding to different planning documents (if perimeters are appropriately established) and the different type of decisions and actions established at that level. As such, this hierarchy recognizes that different types of decisions influencing the organization of transport and urbanism are made at different processes; these include decisions concerning settlement patterns across the entire territory, which can greatly influence the demand for mobility and, thus, GHG emissions. In theory, when the SCOT is established at the level of the greater urban area, the integration of GHG criteria into the decision-making process would potentially allow a greater influence on settlement patterns. When paired with the integration of GHG criteria into the PDU at the *meso* level (decisions about how to provide transport services within an existing urban configuration) and individual projects at the *micro* level, GHG mitigation is potentially able to influence the majority of decisions made.

The different levels of inventories correspond to not only different perimeters, planning documents or projects, but also have impacts on the type of GHG quantification potentially required, the level of detail as well as the approach taken. At the *macro* level, given that fewer specific details concerning settlement patters other than the rough localization of activities are known, a highly detailed, precise approach may be of less use. Rather, focusing more on the magnitude of impacts of different choices may be sufficient to influence decisions making. Integration or mainstreaming is equally important at the *meso* level or that of the individual planning documents that translate both sectoral objectives as well as the over-arching development strategies outlined in the SCOT into a specific administrative jurisdiction. At this level, choices are made concerning the distribution of activities within a smaller perimeter (PLU, PLH), as well as how this distribution can be best served by both public and private transport options (PDU). As such, decision makers are able to understand both the co-benefits of GHG mitigation as well as the effects of individual decisions, policies or programs on emissions and related issues. Finally, at the *micro* level, or that of an individual project, the amount of data and information necessary to conduct a full cost-benefit analysis may be available; however, the smallest room for maneuver may exist in terms of reducing emissions. While specific decisions concerning technologies, materials, path, etc., can influence a project's emissions, it is much more difficult to reduce systemic, large-scale emission sources, such as is possible at the level of the SCOT (i.e. demand for mobility). As such, unless a source of substantial increases in emissions, the most important element is ensuring that a project that would occur no matter its impact on GHG emissions takes the necessary steps to be the least emission-intensive as possible.

While this interrelated hierarchy of tools may be functionally desirable, it poses a number of difficulties in terms of methodological considerations. Different levels of deployment, different functions, and different levels of detail appear necessary to make sure that the information produced is salient for decision making. However, these differences have implications for methodological definitions, perimeters, etc., as well as questions concerning how to produce such a coherent system within a fragmented institutional context.

5.2. Towards a Common Methodological Basis for GHG Information Tools?

The increasing number of information tools being developed for use in the reduction of greenhouse gas emissions across different sectors poses the question of the harmonization of methodological approaches. While, in general, the range of quantification approaches are similar, addressing the need for consistent, transparent and–when possible–comparable results requires looking into the details of how quantification occurs. As such, harmonization requires a common agreement, both in terms of the technical choices made in calculation (gases, data sources, emission factors, etc.) but also the normative issues in terms of setting the perimeter for analysis and the assigning of responsibility for emissions.

While harmonization appears necessary to a certain degree, it is equally important to recognize the need for the contextualization of methodological approaches in order to ensure the continued saliency of the information and expertise produced. Different approaches will continue to be necessary. The functional uses of different information tools (yearly tracking vs. in-depth diagnostics) will require, in some instances, an accounting of only direct emissions and, in other cases, a full life-cycle analysis. Further, differences in data quality and availability will continue to influence the different methods used. Finally, the need for results contextualized for actors groups or sectoral purposes will influence how results are linked to other policy issues and priorities.

Achieving harmonization appears, thus, to be subject to two trade-offs. First, a trade-off between *cost* and *accuracy*. Typically, as the number of emission sources, institutions and actors increases, so does the relative data requirements and thus, in most cases, the cost of data collection and treatment. Second, a trade-off between *action* and *comparability* is apparent in different demands resulting from internal and external uses. While these two uses are not incompatible, the need to produce inventories, whose results allow for local-level *action*, and, thus, responding to the needs of specific uses and policies, is often presented in opposition with a need for *comparability* in terms of the homogeneity of methodologies to ensure the value of results for external, comparative purposes. As such, any harmonization of methods must be flexible enough to allow individual local authorities to produce information suited to their needs.

Assuring flexibility as well as a harmonized approach appears to require definitions for a set of common methodological parameters, while allowing a second set to vary among applications. As such, definitions need to be established to create a common understanding of perimeter (operational, jurisdictional competencies, territorial), sectors, responsibility for emissions, as well as what is included in each emission scope. Then, guidelines should be established to create coherence within uses among a second set of parameters, including: the perimeter used, GHG gases included, scopes included, frequency, data sources, emission factors. Further, the reporting of GHG emissions should include activity data and emission factors as well as an estimation of the uncertainty due to data quality and methods used. Finally, the reporting framework for the resulting emissions data itself should be structured to foster common reporting as well as be useful to the needs of local authorities,, thus, disaggregating emissions by operational sectors (transport, waste, buildings and facilities, etc.).

In France only a handful of different operational and territorial inventory methodologies appear to be in use currently by local authorities (*Bilan Carbon® patrimoine et serices / territorial*, *Cadastral Territorial Emissions (AASQA)*, as well as a number of internally and regional-specific methodologies). Nevertheless, this variety continues to lead to differences in results. As stipulated by the 2010 *Grenelle II* legislation, guidelines have been produced to assist local authorities in the quantification of greenhouse gas emissions stemming from their internal, operational activities. While containing a number of deficiencies concerning how emissions and data are reported, these guidelines have taken steps to set the minimum definitions although a number of improvements could be merited in terms of sectoral definitions and reporting. Given the fragmented, polycentric institutional context for governance of climate as well as sector issues in France, these guidelines have taken the initial steps necessary to establish basic definitions that facilitate exchanges across and among levels.

5.3. The Importance of Boundary Actors and Long-Term Partnerships for Producing Expertise

As suggested by the literature, the production of the needed expertise and information tools for the management of greenhouse gas emissions appears to function more as a system. Rather than producing "more" or "better" information through a one-way flow from expert to decision maker, the production of information is the product of a dialogue among actor groups and the development of a common language. Within an information system, exchanges between the expert or scientific community and decision makers foster the "co-production" of knowledge, which is viewed as salient, credible and legitimate for all parties involved (Tribbia and Moser 2008). This chapter has explored how the two cases studied here have begun to institutionalize such an arrangement among stakeholders, including decision makers, experts, staff and private and non-governmental actors.

To foster the production of GHG expertise and information tools, both Grenoble Alpes Métropole and Nantes Métropole have sought to internalize the necessary competencies. In doing so, it appears that they have created what could be termed as "boundary actors" embedded within the existing institutional arrangements. In Grenoble Alpes Métropole, the *Observatoire du Plan Climat* based within the *Agence Locale d'Energie et du Climat* (ALEc) plays a key role in producing GHG information. In Nantes Métropole, a dedicated staff member within the larger *Services Animation Development Durable et Climat* is re-appropriating methodological approaches developed by external consultants and working with the various divisions to develop information tools.

These actors fulfill many of the roles that "boundary organizations" ensure in the literature. In terms of *convening and communication*, in both Grenoble Alpes Métropole and Nantes Métropoles, these actors work with elected officials, the different departments and divisions of the inter–communal structures, actors from individual *communes*, as well as experts from universities, technical bodies and consultancy companies. This tends to occur through existing structures, whether the *Forum Climat.* which brings together a wide range of actors around the climate action-plan process or through the different advisory councils that exist. Further, whether information tools are developed internally or externally, the boundary actors play an important role in translating the needs of departments and political actors as well as the inputs of expert groups. In both cases, the boundary actors have been active in developing customized methods, working with individual departments either to develop tools internally or work with external consultants to do so, as well as interface with local and regional expert groups. While it appears that these boundary actors play an important role in fostering the development and appropriation of information tools, more research appears necessary, nevertheless, to understand the specific strategies used to mediate among stakeholders.

Second, both of the inter–communal structures have begun to foster lasting relationships with the local or regional AASQA (ASCOPARG in Grenoble, *Air Pays de la Loire* in Nantes) as well as a number of technical bodies at the regional level. These external partners typically play a key role in the provision of technical expertise, data and analysis needed to develop and maintain information tools and inventories. For example, the work of Grenoble Alpes Métropole with the ASCOPARG has allowed *La Métro* to tailor a methodological approach and produce an annual estimation of emissions using a methodological coherence across years. Given the public-services orientation of the ASCOPARG, its non-profit structure and the access to a rich dataset, the *Observatoire* is able to follow emissions with a frequency and level of precision that would not have been feasible (manpower, finance) if it were solely reliant on external consultants or internal data collection. Further, while the methodology produced for use at the level of Grenoble Alpes Métropole has been contextualized, using available direct activity data, the methodologies used to collect, estimate and model a significant portion of data used is coherent with the methodologies used by other actors across the Rhône-Alpes region. While further research is necessary, it appears that AASQAs and other regional-level technical bodies are also playing an important role in other regions (Alsace, Franch-Comté).

5.4. Lessons and Recommendations

Drawing from the above analysis, a number of lessons and recommendations can be identified in terms of the production, harmonization and appropriation of GHG information tools for actors at multiple levels of government. As seen in Table 64, a number of over-arching strategic orientations can be established for actors at both the national and inter–communal level as well as for regional-level actors. Principally, actors at all levels need to work to foster the integration of GHG information tools into decision making. This needs to be accompanied by the technical resources to do so, along with a methodological basis to establish coherence among the different tools. This leads to diverse policy strategies at the different levels of government. At the national level, fostering GHG information tool production may require the establishment of a mandate to do so, whether voluntary or obligatory, paired with the availability of resources to put initial quantification programs into effect. The State equally has a role to play in providing the needed technical resources to produce the inventories by working with and recognizing the key roles of the existing actors, such as the AASQAs in France, as well as other national (ADEME) and sub-national entities. Further, the State has a key role to play in fostering coherence across the application of GHG information tools. The production of guidelines for operational inventories, as has occurred in France, as well as territorial approaches can establish the needed base definitions and methods that can be contextualized to different applications.

Unsurprisingly, local authorities, and particularly inter–communal structures in France, have a role to play in fostering the production, appropriation and coherence of GHG information. The cases studied here suggest that the credibility and legitimacy of the information produced can ensure and enhance the development of an internal technical capacity on GHG quantification, whether in the form of a boundary actor or agency as discussed above. Further, the development of long-term partnerships with technical expertise organizations, such as the AASQAs, plays a role in improving the technical quality, as well as the coherence across time, of tools. Further, coherence can be additionally assured through the adoption of national and/or regional approaches that are sufficiently flexible to adapt to local needs. In addition, the internal harmonization of basic definitions and methods across tools conducted or contracted by the inter–communal structure is an important step that both cases studied here to date need to address. Finally, fostering the appropriation of information requires that the production of GHG expertise and the corresponding results be integrated into decision-making processes in a timely fashion. This often requires that results be contextualized and linked or juxtaposed with other policy priorities to improve comprehension and acceptance by actors.

In conclusion, the above analysis indicates that regional actors equally have a role to play in improving the coherence and production of GHG inventories. The above research has identified the sharing of resources and data at the regional level in a number of locations in France on GHG-related subjects. Regional expert bodies, through either the associations or State-sponsored bodies, are vital in assisting urban authorities, such as in Grenoble Alpes Métropoles and Nantes Métropoles in the development of their territorial GHG reporting. Further, they equally have the potential to be key actors in assisting smaller cities and rural areas to quantify GHG emissions. These regional structures also have the potential to be a bridge in the harmonization process, as they can both influence the development of national guidelines and standards based on experience gained working with local actors as well as foster the adoption of harmonized approaches by their partners.

Table 64: Recommended Strategic Orientations, General Policy Strategies and Needed Modifications

	Strategic Orientations	General Policy Strategies	Specific Modifications Needed
French Central State	- Foster integration of GHG information tools at all levels - Provide technical resources - Ensure coherence among GHG information tools	Foster GHG information tool production requires: - Mandate for production (operational & territorial) - Financing for GHG inventory and analysis programs Technical resources: - Work with existing technical centers to foster development of internal capacities of local authorities Coherence: - Harmonization of common definitions for GHG quantification - Centralization of reporting and information on methods used - Work with local governments to develop guides and ensure credibility and legitimacy (buy-in)	Methodological Guidelines: - Improve reporting format of existing guidelines to better correspond to needs of local authorities (ex ICLEI reporting framework) - Production of guidelines for territorial inventories (*in progress*, in cooperation with the AASQAs) Production & Technical Assistance: - Recognize AASQAs as key partners for the development of sub-national GHG inventories Finance: - Provide subsidies for initial diagnostics linked with methods and guides - Explore programs for financing for mitigation based on sectoral or territory-wide performance (i.e. BASEMIS)
Intercommunal Structure	Foster: - Production and appropriation of GHG information - The saliency, credibility and legitimacy of produced expertise - Coherence and continuity across tools and approaches	Credibility and legitimacy: - Develop internal technical capacity (boundary actors) on GHG quantification (preferably in an independent agency) - Develop long-term partnerships with partner technical expertise organizations (i.e. AASQAs, regional expert bodies) Coherence and continuity: - Adopt national/international harmonization processes when possible - Harmonize of definitions and methods across planning documents and policy areas - Provide of technical support to lower-tiers of authorities (i.e. communes) Saliency and appropriation: - Produce annual and punctual expertise - Include of GHG expertise production and results into decision-making and coordination process including elected officials - Link of GHG mitigation with other policy priorities	Nantes Métropole - Develop partnership with *Air Pays de la Loire* to establish an annual territorial inventory - Adopt common definitions and ensure coherence among the different methodologies currently in place (*100 Actions*; *Bilan Carbone*® of projects and departments, territorial approach) as well as sectoral mainstreaming tools (PDU, SCOT) Grenoble Alpes Métropole - Adopt common definitions and ensure coherence among the different methodologies currently in place (internal emissions tracking; *Bilan Carbone*® of projects and departments, territorial approach) as well as sectoral mainstreaming tools (PDU, SCOT)

CONCLUSIONS:
ENSURING THE LONG-TERM TRANSVERSAL INTEGRATION OF GHG MITIGATION INTO LOCAL DECISION-MAKING

1. INTRODUCTION

This dissertation has studied the pressing collective–action problem posed by the need to reduce greenhouse gas emissions to avoid further changes in mean global temperature. The following sections briefly summarize the research questions treated in this dissertation, as well as the principal conclusions, which have been divided into three sections. First, Section 3 presents the contributions of this work to the larger body of theory and general and detailed lessons for policy practice. Section 4 presents a number of policy recommendations for France. Finally, Section 5 explores a number of concluding thoughts and questions for further research.

2. COLLECTIVE ACTION AND POLYCENTRICISM: GOVERNANCE CHALLENGES AND EXPERTISE

Taking an interdisciplinary approach, this project has drawn on recent developments in collective action theory, institutional economics and the *commons* (Poteete et al. 2010; Ostrom 2009; Dietz et al 2008), theories on multilevel and polycentric governance (Ostrom 2009; Hooghs & Marks 2003) and governance tools and expertise (Cash & Moser 2008; Lascoumes and Legales 2004) to analyze what appears to be a polycentric governance model capable of achieving GHG mitigation objectives. Placing this research within this theoretical framework, the project has posed the over-arching question of *what governance changes are needed to deliver lasting GHG emissions reductions in the urban passenger transport sector?* Using this question as a point of departure, this dissertation has treated two inter-related questions focusing principally on the urban passenger transport sector in France:

- *How do governance challenges influence the expertise necessary to inform and drive GHG mitigation in the urban passenger transport decision-making process in France?*
- *What is necessary to produce expertise that is credible, legitimate and salient for the urban passenger transport decision-making process?*

To do so, the analysis has studied the intersection of policy actions to achieve GHG reductions, the institutional context within which the governance of transport, urban planning and climate change policy in general occurs, as well as the information tools needed to guide policy development and foster a common framing of this significant challenge. Research questions have been grounded in the concrete case of the urban passenger transport in France. This has allowed an analysis of the governance challenges posed by the need to federate action across multiple levels of government and among traditional sectoral decision-making divisions. Furthermore, in the literature on transport and urban planning there often appears to be a consensus on what policies and actions are necessary to reduce GHG emissions. This doctoral research has addressed how these actions can be deployed within a given institutional context in order to achieve the ambitious mitigation objectives that have been established at the international, national and sub-national levels. Rather than focusing on the politics of a single case or decision, this research has aimed to understand how institutional frameworks and GHG information tools can be structured to ensure the integration or "mainstreaming" of GHG mitigation into decision-making no matter which way the political winds blow.

Section 1 has taken a theoretical approach to understand the collective action around climate change, the institutional mechanisms and tools necessary for its governance as well as the role of different actors across levels of government. Chapter 1 has demonstrated that the application of a modified theory of collective action to GHG mitigation sets a frame within which the mechanisms for cooperation and coordination, together with information on emissions, are key components to foster behavioral change and the development of common policy framing. The analysis explored in Chapter 2 indicates that local actors have an important role to play in reducing GHG emissions through the development and implementation of local policies to complement national and international price and regulatory policies. This is due not only to the existing distribution of jurisdictional competencies on transport and urban planning, but also to the proximity of local authorities to stakeholders and actor groups in facilitating the deployment of policies while fostering learning and appropriation.

Section 2 has explored how the specific institutional context found in France framing transport and urban planning as well as the larger policy structure in place to address climate change fosters or limits the reduction of greenhouse gas emissions. Chapter 3 suggests that a number of mechanisms, policy tools and institutional modifications have been introduced to coordinate action between transport and urban planning. Nevertheless, the institutional context continues to present a fragmented policy environment to achieve coordination, resources and capacity limitations to introduce GHG mitigation at the scale necessary to achieve objectives. This fragmentation has illustrated the importance of modifying institutional arrangements when possible, developing processes to coordinate actors across traditional boundaries (political and operational) as well as developing a common language and understanding of how to discuss and achieve existing – often synergistic – policy objectives with GHG mitigation. Looking at the specific case of climate policy in France, Chapter 4 has identified climate action plans (*Plan climat air énergie* or PCET in France) and the associated information tools key in the dynamic process to foster the coordination, information and expertise needed for the widespread appropriation of climate issues among local authorities. While these tools have taken an important first step in developing a larger "culture of climate," they have, however, to date been less effective in influencing policymaking in the transport sector.

Section 3 has built on the two previous sections to explore how information tools and expertise are being used to foster this needed sectoral mainstreaming, along with the implications of an increasing number of GHG tools on their appropriation, methodological structure and production. Chapter 5 has explored how – to date – climate issues have been integrated or "mainstreamed" directly into transport decision-making, looking particularly at the *Plan de déplacements urbains.* The saliency of the sectoral mainstreaming of GHG mitigation criteria is limited first by deficiencies in the integration of environmental criteria in general (timing, scenarios) as well as the technical aspects of the tools themselves (methods, quantification, scope of tools, linking with other policy priorities). A number of limitations remains in moving from expertise to the identification and appropriation of the packages of actions and policies needed to reduce emissions. Finally, Chapter 6 has identified a nascent hierarchy or "information system" of GHG expertise tools taking shape corresponding to their multiple applications. This has a number of implications for the production and appropriation of information by decision-makers, as there is an apparent need for the harmonization of a number of basic methodological choices and the development of partnerships and the necessary internal competencies to foster the co-construction of expertise.

Perhaps most importantly, achieving greenhouse gas mitigation and other climate change objectives appears dependent not only on the ability of actors to coordinate action, but also on the information tools needed to integrate these issues into the decision-making process at multiple levels of government and across policy priorities. Thus, GHG mitigation must be linked as an often-complementary issue with existing policy priorities. The analyses and findings resulting from this dissertation have a number of contributions to make both to the theoretical literature upon which it is based as well as to general policy practice and the specific decision-making process in France in terms of transport, urban planning and climate governance.

3. CONTRIBUTIONS TO LARGER THEORETICAL AND POLICY PRACTICE DISCUSSIONS

The analysis of the larger French institutional and governance context, as well as the individual case studies of Grenoble Alpes Métropole and Nantes Métropole, has identified a number of lessons that contribute to larger theoretical and policy-related discussions.

3.1. Contribution to the Theoretical Literature: Polycentrism, Environmental Governance and Expertise for Decision Making

This research contributes to the theoretical literature surrounding the governance of environmental and collective action subjects. While the results of this dissertation do not revolutionize existing theories on collective action, environmental governance systems and the expertise for decision-making, the research has made important steps in testing the relevancy and applicability of these theories to climate change and the greenhouse gas mitigation policy problem.

First, as seen in Chapter 1, greenhouse gas mitigation can be framed as a collective action problem stemming from the management of an open-access common-pool resource. Drawing from recent work on common-property common-pool resource management, the adoption of a "modified" theory of collective action based upon a behavioral theory of the individual (Ostrom 2000; Poteete et al. 2010) allows for a reframing of the climate-change policy challenge. Instead of focusing solely on what policy tools are necessary to impose sustainable use of common-pool resources from the exterior, it appears more important to develop an institutional context within which collective action becomes possible. As such, success is not only linked to incentives or constraints, but also to the provision of information, learning, and interaction among stakeholders.

Second, given the nature of the policy challenge, in which combined local actions can have a significant impact on global outcomes, it appears that actions and multiple levels of government are necessary. Given that a policy subject such as climate change cuts across traditional sectors, levels of government and actors groups, it is not surprising that this research has noted in the case studies that a “polycentric” (V. Ostrom 1999; Ostrom 2009) approach has been taken. Particularly in the case of urban passenger transport - where decision making occurs at multiple points across and among levels of government - a polycentric model is relevant and useful to analyze the governance of GHG mitigation in this sector. Recognizing the multilevel interactions necessary for the governance of climate change, and more specifically greenhouse-gas mitigation, prescribing a single, centralized, institutional configuration is difficult, if not impossible. The polycentric approach stresses that instead of a single best design, governance should be based on a set of core principles to structure local institutions (Ostrom 2009). This approach is well structured for dealing with climate change in cases where mitigation action is required across multiple levels and sectors, with regrouping activities functioning at different levels.

Thus, the study of the French institutional context and the two case studies has, in many instances, revealed a decentralized model of governance often with inter–communal structures (*Etablissement Public de Coopération Intercommunale)* serving as sufficient points of centralization to foster the sharing of mandates, technical resources and coordination of action at the appropriate perimeters among and across levels and actor groups. The analysis presented in Chapter 2 indicated that the implementation of the necessary actions to reduce GHG emissions resulting from urban passenger transport necessitates a large “constellation” of actors spanning traditional policy sectors (transport and urbanism) and actor groups (public, private, expert, etc.). This polycentric organization of urban and transport planning advocates the local centralization of the oversight of the development of both transport and urban planning documents. However, this must be balanced with a continued participation of both *communes* and the local population, not only to bring the necessary local contextual knowledge, but also to legitimize the resulting process. As such, coordination of action to reduce greenhouse gas emissions requires finding the common denominator for a wide range of priorities, definitions and measures of success as well as basic approaches in framing issues.

Third, the use of the robust environmental-governance framework proposed by Dietz et al. (2008) to analyze the different governance processes and institutional mechanisms that have been put into place to facilitate the coordination of action within an increasingly polycentric system has demonstrated its relevancy for GHG mitigation. As seen Chapter 3 and below in Table 40, the application of this framework to the management of greenhouse gas emissions helps to reveal a number of specificities that must be dealt with to foster collective action. However, what must be kept in mind is that no “optimal” solution or organizational models exist to overcome these challenges, as both macro- and micro-contextual elements are important (Charbit and Michalun 2009; Foster 1997; Poteete et al. 2010).

Table 65: Robust Environmental Governance and GHG mitigation: Examples from Two Case Studies

Requirement	GHG mitigation specificities
Provide necessary information	Provide information on: - GHG emission sources - mitigation options - financing and implementation
Deal with conflict	Types of conflict: - Over-arching objectives - Relative prioritization - Appropriate tools
Induce compliance with rules	- Participation is principally voluntary - Limited reputational risk - Accompanied with punitive sanctions
Provide physical, technical and institutional infrastructure	Climate–change mitigation often requires: - Transversal coordination across sectors, services, levels and institutions - Technical quantification and evaluation methodologies - Long-term investments in physical infrastructure
Encourage adaptation (in governance) and change	Multiple approaches due to complexity in: - Range of issues treated - Range of actors involved - Time horizons (staying the course and keeping actors involved) - Experimentation with new types of policies

Finally, this dissertation has explored two theories concerning the use of information and expertise in the decision-making processes and their relevancy to understand the integration and appropriation of GHG criteria into policymaking and implementation. Cash et al.'s (2008) theory concerning the saliency, legitimacy and credibility of information for decision making has proved to be a useful framework to analyze the production of expertise for both the larger dynamic surrounding climate action plans (Chapter 4) as well as the mainstreaming of GHG criteria into sectoral decision making (Chapter 5). As predicted by theory, credibility, saliency and legitimacy are key issues linked to the production and structure of the expertise itself, as well as to the larger decision-making process. Further, within the production process of expertise, theory on the role of "boundary" organizations (Cash et al., 2003; Guston, 2001; Gieryn, 1999; Tribbia and Moser 2008; Corfee-Morlot et al. 2011) proves useful in understanding the role of different technical actors in France. In both cases studied, rather than an external agency or organization playing this role, both local governments have assigned this role to a single *actor* integrated within existing larger structures: the *Service Développement Durable et du Climat* in Nantes Métropole or the *Agence locale de l'energie et du climat* in Grenoble Alpes Métropole. These actors appear to play many of the same roles as boundary organizations as described in the literature, negotiating between the political and the technical to foster the appropriation of expert information on GHG mitigation. As such, they play an important role in the production and appropriation of GHG information and expertise by stakeholders and policymakers.

3.2. Lessons for Policy Practice

The above chapters have explored a number of governance questions, including what actions are needed to reduce emissions in the urban passenger transport sector; who needs to be involved in this process given institutional configurations; how the decision-making structure influences the integration of GHG mitigation; and, finally, how information tools influence the appropriation GHG expertise and its integration into policymaking. Through the analysis of the institutional context for transport, urban planning and climate policy policymaking and implementation in France, this dissertation has identified lessons for policy practice.

First, a number of general conclusions can be drawn concerning the actions, institutional configurations, decision-making processes and tools needed for the governance of GHG emissions:

- *What:* Reducing emissions in the urban passenger transport sector requires coordination of transport and urban planning across multiple levels of government and among multiple policy sectors. (Chapters 1 and 2)
- *Who*: Sectoral institutional configurations across and among levels of government and the structure of coordination mechanisms (climate action plans) influence the ability of local actors to address GHG mitigation due to fragmentation of competencies, jurisdiction as well as limitations on resources and capacities. (Chapters 3 and 4)
- *How*: The structure of the decision-making process enables or limits the integration or mainstreaming of GHG mitigation into policies and actions. (Chapters 4 and 5)
- *Through what tools:* The perceived and actual credibility, legitimacy and saliency of information tools used in the policy process influences their appropriation by actors and the integration of GHG expertise into the policy process, and thus, their ability to affect individual policy choices. (Chapters 5 and 6)

In addition, a number of policy-oriented conclusions can be drawn based on this analysis of the French context. First, the deployment of Climate Action Plans (PCET) represents an important step in instilling a macro-level climate dynamic across local governments and within the general population. As such, they appear to take important steps to frame GHG mitigation as a policy priority for the local authority. However, these plans appear less capable of integrating GHG criteria into the sectoral decision-making processes themselves. Rather, as seen in the two case studies examined here, sectoral mainstreaming or integration of GHG criteria into the transport decision-making process has begun to occur in order to influence directly the choices and strategic directions being established.

Second, within the governance process, information and expertise on greenhouse gas emissions play a vital role. A wide range of GHG information tools is being developed for different applications ranging from the larger climate action-plan dynamic (such as inventories of operational or community emissions) to the detailed life-cycle analysis of GHG emissions for individual policies or services (waste treatment, procurement, etc.). The deployment, however, of such a broad range of tools has implications for their production and appropriation. There appears to be a need for a basic level of harmonization of the methodological approaches and definitions to ensure that results are credible, coherent and salient. The internalization of the technical capacity to develop GHG information while establishing long-term partnerships with technical bodies is an important step in ensuring that information is both technically sound and relevant for decision-making.

Third, even in a governance context in France with a historically strong culture of planning, coordination and evaluation of plans and projects, the introduction of GHG criteria will not produce immediate results. Going beyond questions on climate change, it appears that planning documents and project evaluations are used as perfunctory ex-post exercises rather than an analysis of competing scenarios for development. Nevertheless, these documents do play an important role in setting the limits on the type of development activities that can occur, thus representing an important backstop to major negative environmental and social impacts. As such, there is little doubt regarding the importance of the elaboration of the *Plan de déplacements urbains* (PDU) and that the production of a concrete document typically presenting a program for transport development spans five to ten years. This "lock-in" of a strategy and program of actions fosters coherence among different sectors and planning tools, such as transport and urbanism; once approved it affords the transport strategy a certain measure of protection from changes in politics. Nevertheless, to date these plans appear unable to introduce the systemic change necessary to reduce greenhouse gas emissions at the scale needed to achieve ambitious 2050 emission-reduction targets.

3.3. Detailed Lessons and Recommendations

3.3.1. What Actions Need to Be Taken

1. ***While price and regulatory signals appear to be pillars upon which greenhouse gas mitigation policy should be and is being built nationally and internationally, complementary policies are, nevertheless, needed to achieve emission–reduction targets*.** As seen in the case of urban passenger transport, a number of barriers limit the effective transmission of price and regulatory signals from the global/national to the local level. These barriers stem not only from characteristics of the market itself (oligopoly, increasing returns to scale, capital stock lock-in), transaction costs, externalities, but are also tied to barriers to achieve behavioral change and linkages with other markets (capital, real-estate, etc.). Overcoming these barriers requires a range of complementary actions and policies from both the transport- and urban-planning sectors. These actions potentially serve to enhance the influence of price and regulatory signals and create a context for non-marginal and successful GHG mitigation.

2. ***The complementary policies needed to reduce transport emission go beyond transport policy and must also address issues of urban planning*.** Reducing greenhouse gas emissions in the transport sector is often not about doing anything particularly different or new, but, rather, about doing existing actions *better*. These actions are typically transversal in nature, touching both transportation policy as well as urban planning. Through coordinated policies influencing technology changes, reducing the number of trips, reducing the distance traveled, modifying the modal share and treating issues of urban and public-transport attractiveness, significant steps can be made towards reducing emissions. Often, significant synergies exist among current transport objectives, mandates and the reduction of GHG emissions. It is important to remember that GHG emission reduction functions as a co-benefit of other policy priorities (social, economics, etc.) and, thus, often have little qualitative or quantitative weight in policy making themselves. As

such, it appears that achieving emission–reduction goals requires linking climate-related objectives with existing policy priorities.

3.3.2. Who Needs to Be Involved in Reducing GHG Emissions

3. ***Action to reduce GHG emissions in the transport sector implicitly involves actors at multiple levels of government to implement policies. As such, the success of a polycentric system will depend on the ability of its actors to coordinate and communicate, while, at the same time, overcoming the different limitations.*** As seen in Chapter 3, barriers stemming from administrative, policy, objective and information gaps limit the ability of actors to work together across often over-lapping and limited administrative boundaries to develop coordinated, coherent transport and urbanism strategies. Capacity limits reduce the ability of actors to produce the necessary expertise and apply this information when translating over-arching objectives and strategies into concrete policies and actions. Funding gaps limit the ability of public actors to launch investment in urban-development and transport-infrastructure projects that could potentially attract complementary private-financial flows. Finally, accountability gaps limit the attribution of responsibility to specific actors and, thus, limit the necessary incentives for the good intentions to be translated into concrete actions.

4. ***Institutionally, even in a highly rationalized and logical planning culture as in France, fragmentation of policy jurisdiction, responsibility, priorities and issues framing, as well as a significant limitations of resources (financial and capacity), limit the ability to achieve emission-reduction goals.*** These fragmentations and limitations extend across transport and urban planning as well as the general institutional framing for climate policy. As seen in Table 36, *administrative fragmentation* can limit the federating of the actors necessary to reduce greenhouse gas emissions. *Jurisdictional fragmentation* leads to a fragmented decision–making and implementation context within which coordination of the relevant parties becomes difficult, if not impossible. Differences in *objectives and priorities* can form when issues are framed and perceived differently, thus suggesting that forms of interaction fostering learning are necessary to arrive at common framing and objectives among actors. Limitations on the different resources necessary for governance can equally reduce the capacity to reduce GHG emissions. *Information limitations* restrict the understanding of individual actors concerning their role in reducing emissions. Further, limitations can create information asymmetries among actors, making coordination difficult, suggesting that a common metric(s) or language is necessary to facilitate information sharing. *Capacity limits* affect the technical abilities of the heterogeneous actors to develop and implement necessary policies. *Funding limits* and the various issues related to the calculation of the needs for resources for action limit the ability of actors to engage the issue fully.

Table 66: Impacts of Limitations on the Ability of Local Authorities to Reduce GHG Emissions

Fragmentation of Governance Context	
Administrative Fragmentation	Ability to define the perimeter of responsibility for GHG emissions Ability to coordinate among different actors and institutions functioning at different perimeters
Jurisdictional Fragmentation	Ability to coordinate the range of actors: internally across services and externally across services and institutions functioning within and among levels of government
Objective Fragmentation	Prioritization of climate in relation to other subjects Identification of acceptable solutions
Limitations on Resources for Governance	
Capacity Limitations	Ability to evaluate: impacts of GHG-mitigation actions; interaction among sectors; systemic effects Ability to perform multi-criteria analysis Ability to translate general orientations into actions and policy prescriptions Ability to ensure coherence among multiple, diverse policy sectors (mainstreaming) Ability to provide necessary levels of oversight and technical assistance
Information Limits	Ability to track, measure and communicate: objectives, means, progress and final results Ability to identify actions and levers to reduce greenhouse gas emissions
Funding Limits & Fragmentation	Ability to identify additional costs linked to GHG reduction Ability to secure the level of financing necessary Ability to manage the complex nature of the financial mechanisms

3.3.3. How to Overcome Fragmentation and Achieve Transversal Coordination

5. ***There is a clear need for coordination both across and among levels of governments, sectors, etc. to foster the collective action necessary to reduce greenhouse gas emissions.*** A number of modifications of the transport and urban-planning sectors have occurred aimed at improving transport and land-use planning to halt urban sprawl, promote the use of public transport and reduce the role of the private vehicle in urban areas while simultaneously reducing local air pollution.

6. ***Climate action plans and the dynamic they create across local authorities - as well as engaging external actors - are important parts of fostering the information exchange, expertise and coordination necessary for collective action on GHG mitigation.*** The introduction of Climate Action Plans or PCET in France has served as the principal means of coordinating action around GHG mitigation objectives. The strength of the climate action plans for both Grenoble Alpes Métropole and Nantes Métropole appears to lie in the development of dynamic participation-based processes. Rather than a laundry list of mitigation actions, local authorities are working with a wide range of actors to facilitate dialogue and learning on climate-related subjects as well as the actual reduction of emissions. While often taking different institutional approaches and different policy mechanisms, they have been able to overcome the different barriers linked to the complex multi–level governance context.

    a. *As seen in Table 43, both EPCI[137]s have put their climate action plan in place at the level of the entire inter-communal structure, led principally by the central authority.*

[137] *Etablissement Public de Coopération Intercommunale*

They have engaged member *communes* and other local actors, either through a system of contractual pledges in the case of Grenoble or through the existing network of *"référents climat"* or through Nantes' *pôles de proximité*. These actions, combined with other coordination mechanisms, have allowed the EPCIs to move towards overcoming identified administrative and jurisdictional fragmentation. In addition, these different coordination mechanisms often focus on fostering exchanges and learning among actors, and hold the potential towards achieving convergence in terms of framing the climate-change problem and the definition of shared objectives.

b. *Different structures have been put into place to deal with conflict and accountability, often focusing on network-based approaches to foster dialogue among different services and actor groups, together with yearly meetings to bring all actors together.* Compliance with rules has been fostered through voluntary contractual arrangements as well as monitoring and internal reporting. A variety of institutional models to foster coordination, dialogue and transversal action have equally been developed and implemented.

Table 67: PCET Solutions to Gaps on the Ability of Local Authorities to Reduce GHG Emissions

<table>
<tr><th></th><th>Grenoble Alpes Métropole</th><th>Nantes Métropole</th></tr>
<tr><td colspan="3">Governing a Fragmented Context</td></tr>
<tr><td rowspan="2">Administrative Fragmentation</td><td colspan="2">PCET led at the level of the EPCI, coherent with the majority of planning documents</td></tr>
<tr><td rowspan="3">- Targeting of partner organizations to federate them into the larger, dynamic process (communes and the private sector)
- Internal coordination: European Energy Award, Plan d'Actions Transversal;
- External coordination: Charte d'engagements; annual reporting and action plans</td><td rowspan="3">- Agenda 21 network (referants climat)
- Internal coordination: Mobilization of public policies; Seminars
- External coordination: Pôles de proximité ; thematic groups</td></tr>
<tr><td>Fragmented Jurisdictions</td></tr>
<tr><td>Fragmented Objectives</td></tr>
<tr><td>Fragmented Funding</td><td>- Tableau de bord</td><td></td></tr>
<tr><td colspan="3">Information and Expertise for Collective Action</td></tr>
<tr><td>Capacity Limits</td><td>- Scientific council
- Partnerships with related organizations (AURG, ASCOPARG – see Chapter 6)
- Tableau de bord
- European Energy Award
- Agence Locale d'Energie et du climat</td><td>- Scientific council
- Development of internal capacity (GHG quantification)
- Mobilization of public policies
- Pôles de proximité / existing structures–EcoPole, Espaces Info Energie, Allo Climat</td></tr>
<tr><td>Information Limits</td><td colspan="2">- Hierarchy of GHG information tools (territory, policies & strategies, project lifecycles)
- Development of internal GHG-quantification capacity
- Partnerships with technical bodies: ASQAs, urban planning agencies, others</td></tr>
<tr><td>Accountability</td><td>- Charte d'engagements and individual action plans</td><td>- Mobilization of public policies (100 Actions)</td></tr>
</table>

7. ***Information, expertise and its integration into decision making to develop a common framing and language on climate-related subjects are necessary governance tools in fostering the collective action needed.*** Grenoble Alpes Métropole and Nantes Métropole have also taken significant steps towards addressing limitations on information and expertise to foster coordination and collective action. Often developing long-term partnerships with expert organizations and associations, the two EPCIs have developed the internal capacity necessary to produce as well as incorporate information to govern GHG mitigation.

   a. *Each EPCI has developed the programs and tools to provide necessary information, often going beyond the simple provision of quantified greenhouse gas emissions to contextualize mitigation actions for different actor groups better.* This development of a general culture around greenhouse gas mitigation appears linked not only to the existence of mitigation objectives and inventories, but also to the production process itself. As such, the idea of the co-construction of expert information with the full range of actors was often raised by interviewees.

   b. *For a number of actors, the value of the GHG inventory within the GHG-mitigation process went beyond that of a "number," becoming, rather, a means of starting a dialogue among actor groups*. The development of a common "language" with which GHG mitigation efforts can be planned and discussed has helped many actors understand their role in achieving emission-reduction objectives better.

   c. *An important component of the appropriation has been the contextualization of the different measures to specific sectors through a continual dialogue*: This is the identification of the most appropriate unit of measurement and educating actors to what it specifically measures, as well as how it can be used to influence action.

8. ***Achieving the ambitious Facteur 4 greenhouse gas-emission-reduction objective requires the sectoral integration of a mitigation logic to understand how a wider range of policies impacts greenhouse gas emissions.*** Climat action plans to date in the two case studies do not appear to be sufficient to ensure the integration of GHG criteria into sectoral decision making. Achieving GHG-emission reductions in the urban passenger transport sector requires changes in the PDU, which outlines the larger transport strategy for the *agglomeration*, as well as changes in addition to the accompanying urban-planning documents (SCOT - *Schéma de Cohérence Territoriale*, PLU - *Plan Local d'Urbanisme*, PLH - *Programme Local de l'Habitat*).

   a. *While the climate action plans of Grenoble Alpes Métropole and Nantes Métropole are able to include ambitious transport policies that contribute to the reduction of GHG emissions in the transport sector, this does not represent the fact that the climate action plan has or will have an impact on how transport policy is formulated.* Rather, the PDU in vigor, which tends to predate the development of climate action plans, responds to earlier requirements linked to energy-efficiency policies from the 80s and 90s.

b. *While synergies exist, in terms of shared policy objectives to foster a modal shift and reduce urban sprawl, climate action plans are limited in how they influence the trajectory of transport and urban policy further.* The majority of actors interviewed stressed that historical trends, rather than the introduction of new priorities from the PCET process, have led to the relative stabilization of emissions from this sector. Instead, PCET and GHG mitigation have served to give added weight and validity to actions that typically foster the reduction of emissions already.

9. ***In France, mainstreaming and integration of GHG criteria into sectoral decision making has begun to occur; however, it is constrained by a number of procedural issues related to the existing decision-making process and technical issues related to the information tools deployed.*** To date, greenhouse gas mitigation has typically been treated as a new environmental constraint on policymaking. As such, its integration into sectoral policy–making processes appears to have taken a similar approach as other, more traditional, environmental criteria (air and noise pollution, water contamination, etc.), and, thus, through the statutory *évaluation environnementale* that must be conducted for plans and projects above a certain threshold.

   a. *First, the inclusion of analytical-deliberative processes, or those that foster the development of trust, engagement, and discussion, is important to the integration of GHG and other environmental criteria into the decision-making process, given the different framings among actor groups that can affect which issues are prioritized for action and which policies are deemed appropriate.* However, while a number of processes have been put into place, it appears that the development of a system of consultations and public inquiry appears to fall short of the analytical-deliberative processes called for by Dietz et al. (2008) for environmental governance. In terms of integrating different actors into the development of the PDU, the role of the consultation process is limited by its timing within the process. Often structured as an additional "input" rather than an organized discursive process, this "one-off" occurrence does not present the opportunity for an iterative dialogue among the different actors and the AOTU (*Autorité organisatrice de transports urbains*) or other elaborating entity to form. In general, while consultations occur at different moments within the process, they are often seen as a procedural step to avoid legal action linked to deviations from statutory procedures.

   b. *Second, the évaluation environnementale of planning documents and programs has a number of deficiencies that reduces the ability to integrate environmental criteria into decision making.* The larger issue at stake is whether the information produced responds to the needs of the decision makers at the moment that it enters into the process. It is recognized that the cost-benefit analysis conducted to measure the impact of projects, and - more recently - planning documents, has its limits in terms of responding to these needs. While total costs are helpful, the distribution of these costs, often a much more politically relevant question, is often not easily visible. Further, the issue of timing is utmost. The process should, in theory, be iterative and accompany the entire development of the PDU, thus ensuring that environmental considerations are on the policy agenda from start to finish, influencing both initial framing and subsequent evaluation. Rather than occurring during the initial or medium-planning stages, where changes can still be made, the information "arrives" at a moment when there remain few substantial choices that can influence the structure of a project or even the choice among competing projects. As such, it may serve currently only as an ex-post rubber-stamping of decisions made elsewhere.

10. ***The introduction of the reduction of greenhouse gas emissions into the policy–making process surrounding urban passenger transport does not appear to have caused a rupture in the larger policy strategies and the specific actions put into place. Rather, it appears to have added further validation and priority to a number of different policy trends dating from mandates concerning the reduction of personal car use and urban sprawl, energy efficiency and the development of public transport networks all of which date from the 1990s or before.*** It is conceivable that GHG information can be used to justify a project that would equally achieve other objectives. However, it seems relatively unlikely that GHG reductions will be the incentive to reverse existing trends. This is especially the case given that mobility and infrastructure development tends to be an induced demand depending on the location of residential, commercial and leisure activities.

3.3.4. Information Tools for GHG Governance

11. ***Expertise and information tools on greenhouse gas emissions play an important role in policy formulation, implementation and evaluation.*** Greenhouse gas inventories are typically designed for a number of overlapping applications that while, in theory, should be conducted sequentially, are rarely done so in practice (i.e. conducted simultaneously, conducted out of order). Often, their initial purpose lies in the identification and planning of mitigation policies. This includes performing a diagnosis of existing emissions and identifying "baseline" emission trends. A diagnostic phase is typically followed by the development of emission-reduction scenarios to analyze the potential impact of different types of actors prioritized by cost, relevancy, or existing policy path dependencies. Once a set of GHG-mitigation actions are developed and implemented, inventory tools are needed as indicators of progress, tracking both the real impacts of individual actions as well as the overall "macro" progress at a given level (whether that of a single actor or an entire territory). Inventories equally have an important role to play in communicating mitigation progress, whether for statutory or voluntary reporting among entities with the larger public or to promote discussion with partner actors.

12. ***Grenoble Alpes Métropole and Nantes Métropole have integrated greenhouse gas mitigation criteria and expertise integrated into the Plan de déplacements urbains decision-making process, as well as the integration of a price on CO_2 emissions into the cost-benefit analysis of individual projects. Nevertheless, in addition to the issue of timing identified above, the mainstreaming of GHG mitigation in the PDUs studied indicates that the saliency of the information produced in the process presents a number of limitations.*** Different GHG–information tools have been used to date to introduce GHG evaluation criteria and analysis into the diagnostic stages of the process,

along with the construction of emission previsions related to specific scenarios and the evaluation of individual actions and projects. The case studies have shown that a range of quantitative and qualitative methods have been employed to bring the needed expertise concerning the impact of choices made in the development of urban passenger planning documents on GHG emissions.

a. *First, limitations in terms of the saliency of the GHG expertise incorporated into the diagnostic process can be linked to the often highly aggregated nature of the results produced.* This aggregation renders it difficult to identify the appropriate actions to take to reduce emissions as well as which policies are necessarily responsible for current levels.

b. *Second, the integration of GHG criteria into the development of scenarios appears limited more by how scenarios are currently developed and used than by the technical inclusion of the GHG expertise itself.* While a technically sophisticated quantification of GHG emissions has occurred, the scenarios evaluated in and of themselves appear to have little value in making choices among individual actions and policy packages.

c. *Third, limitations on the saliency of information equally extend to the observed analysis of specific policy actions within the PDU as well as within the cost-benefit analysis of individually approved transport projects.* Within their 2010-2015 PDU, Nantes Métropole used a qualitative analysis tool to compare roughly the impacts on different criteria (air quality, climate, economic, etc.) of multiple types of action. While further development of the qualitative methodology and its use appears necessary, this type of information tool appears to allow decision makers to compare easily the range of impacts among different environmental priorities and assess trade-offs without using a common denominator or applying a monetary value.

d. *Finally, the analysis of individual projects that have been approved for construction is typically dominated by cost-benefit analysis (CBA).* However, within this analysis, the value of GHG reductions (as well as other environmental issues) is greatly overshadowed by other benefits, such as time savings and security. While CBA is an important tool in project analysis, it appears that it may be less suited to introduce a long-term concern that, nevertheless, requires present-day action such as GHG mitigation.

13. ***GHG information must be incorporated not only in the choice of transportation networks and systems, but also in the decisions surrounding urban planning and territorial development.*** Thus, to treat transport emissions it appears necessary to integrate GHG criteria into the decision-making process surrounding the SCOT (*schéma de cohérence territorial*) as well as the PLU (*Plan local d'urbanisme*).

Table 68: Distribution of planning competencies across levels and across

Sectoral Implications			
Level	**Macro–Systemic**	**Meso**	**Micro**
	Greater urban area	**EPCI jurisdiction**	**Individual communes**
Urbanism	- *Schéma de cohérence territorial* (SCOT)	- *Schéma de secteur* - *Plan Local d'urbanisme* - *Programme locale d'habitation*	- *Plan local d'urbanisme* - *Autorisation de constuire*
	- Distribution of activities across the metropolitan area (employment, residential, services)	- Distribution of activities within EPCI - Residential vs. business districts	- Location with *communes* - Mixed-use areas - Density along public transport lines
Transport	- *Schéma de cohérence territorial* (SCOT)	- *Plan de déplacements urbains* (PDU)	- *Plan de déplacements urbains* (PDU) - *Plan de déplacements entreprise* (PDE)
	- Infrastructures for rail and road (inter/suburban) - Urban / suburban interactions	- Localized transport networks (level of agglomeration) - Urban / suburban interactions - Multi–modal hubs	- Localized networks–project pathways, individual connections, multi–modal hubs
Key Choices	- Interaction among choices of activity localization and demand for mobility	- Interactions among urban and suburban transport network connects and means of concentrating development around hubs that are served by public transport	- Impacts of density and transport service along project corridors

a. *Each of three levels of action - macro, meso and micro - offer different opportunities to reduce GHG emissions.* At the *macro* level or that of the SCOT, decisions are made concerning the settlement patterns across the greater urban area. At the *meso* level - or that of the individual planning documents (including the PDU) - sectoral objectives, as well as the over-arching development strategies outlined in the SCOT, are translated into a specific administrative jurisdiction. Finally, at the *micro* level, once an individual project, whether it is a public transport line or the redevelopment of a neighborhood, has been approved at the *meso-level*, the choices in terms of reducing emissions from the transport sector are most likely marginal. While specific decisions concerning technologies, materials, path, etc., can influence a project's emissions, it is much more difficult to reduce systemic, large-scale emission sources, such as those possible at the level of the SCOT (i.e. demand for mobility).

b. *As key choices are made within each of these decision-making processes concerning actions directly related or synergistic to GHG mitigation, it appears that the mainstreaming of GHG criteria into each one is necessary.* However, it is also important to assess the enforceability and impact of each planning document and process: while integration across decision-making processes appears necessary, the trade-off between the potential to influence difficultly enforceable strategic orientations or concrete policies and actions must be taken into consideration.

14. ***There is a need for multiple tools to be developed and geared for different uses; thus, this research has identified a nascent hierarchy with implications for its methodological structure linked to a need for the harmonization of a number of basic elements***. In the case of the integration of greenhouse gas emissions into transport and urban planning decisions, three different levels can be identified; these correspond to different planning documents (if perimeters are appropriately established) and the different type of decisions and actions established at each level. The different levels of inventories correspond to not only different perimeters, planning documents or projects, but also have impacts on the type of GHG quantification potentially required, the level of detail and the approach taken.

    a. *At the macro level, given that fewer specific details concerning settlement patterns other than the rough localization of activities is known, a highly-detailed, precise approach may be of less use.* Rather, focusing more on the magnitude of impacts of different choices may be sufficient to influence decision making.

    b. *Integration or mainstreaming is equally important at the meso level or that of the individual planning documents that translate sectoral objectives and the over-arching development strategies outlined in the SCOT into a specific administrative jurisdiction.* At this level, choices are made concerning the distribution of activities within a smaller perimeter (PLU, PLH) as along with how this distribution can be best served by both public and private transport options (PDU). As such, decision makers are able to understand both the co-benefits of GHG mitigation as well as the effects of individual decisions, policies or programs on emissions and related issues.

    c. *At the micro level, or that of an individual project, the amount of data and information necessary to conduct a full cost-benefit analysis may be available; however, the smallest room for maneuver may exist in terms of reducing emissions*. While specific decisions concerning technologies, materials, path, etc., can influence project emissions, it is much more difficult to reduce systemic, large-scale emission sources such as at the level of the SCOT (i.e. demand for mobility). As such, unless there is a source of substantial increases in emissions, the most important element is ensuring that a project that would occur no matter its impact on GHG emissions takes the necessary steps to be the least emission-intensive as possible.

Table 69: Hierarchy of Information Tools for Transport and Urban Planning

Level	**Macro–Systemic**	**Meso**	**Micro**
Scope	- Territory	- Agglomeration	- *Commune, zone d'aménagement*, neighborhood
Planning Documents & Perimeter	- SCOT	- *Schéma de Sector* - PLH - PDU - PCET - PLU	- PLU - PDE - Project Documents (*Contrat d'axe*, etc.) - Individual projects
GHG Quantification of:	- Diagnostic of emissions	- Diagnostic of emissions	- Diagnostic of emissions
	- Large-scale structural development scenarios	- Medium scale-zoning impacts - Transport policies and development	- Zoning - Building permits - Projects
Level of detail	- "Order of magnitude" quantification of settlement patterns and choices	- "Order of magnitude" quantification - Some detailed studies of impacts of multimodal hubs and connections between urban/suburban networks	- Detailed studies to identify "marginal" opportunities to reduce emissions
Methodological Approach	- Qualitative - Rough quantitative - Multi-criteria	- Quantitative / Multi-criteria - Rough Cost Benefit Analysis	- Multi-criteria analysis - Detailed cost-benefit analysis - Life-cycle (infrastructure, other)

15. ***Given the need for different information tools to guide policymaking, there is an apparent need for the harmonization of methodological approaches.*** Achieving harmonization appears, thus, to be subject to two trade-offs**.** First, a trade-off between *cost* and *accuracy*. Typically, as the number of emission sources, institutions and actors increases, so does the relative data requirements and, thus, in most cases, the cost of data collection and treatment. Second, a trade-off between *action* and *comparability* is apparent in different demands resulting from internal and external uses. While these two uses are not incompatible, the need to produce inventories, whose results allow for local-level *action*, and, thus, respond to the needs of specific uses and policies, is often presented in opposition to a need for *comparability* in terms of the homogeneity of methodologies to ensure the value of results for external, comparative purposes. As such, any harmonization of methods must be flexible enough to allow individual local authorities to produce information suited to their needs.

    a. *Ensuring flexibility and a harmonized approach appears to require definitions for a set of common methodological parameters while allowing a second set to vary between applications.* As such, definitions need to be established to create a common understanding of perimeter (operational, jurisdictional competencies, territorial), sectors, responsibility for emissions, as well as what is included in each emission scope. Guidelines should be established to create coherence within uses among a second set of parameters, comprising the perimeter used, GHG gases included, scopes included, frequency, data sources and emission factors.

b. *Further, the reporting of GHG emissions should include activity data and emission factors as well as an estimation of uncertainty due to data quality and methods used.* Finally, the reporting framework for the resulting emissions data itself should be structured to foster common reporting while being useful to the needs of local authorities, thus disaggregating emissions by operational sectors (transport, waste, buildings and facilities, etc.).

16. ***The appropriation and long-term integration of this information into decision making appear to be linked to how it is produced***. There is a trend towards the development of the internal, politically neutral, capacity to produce this expertise as well as the development of long-term partnerships with technical bodies to supply needed technical capacity and data.

a. *To facilitate the production of GHG expertise and information tools, both Grenoble Alpes Métropole and Nantes Métropole have sought to internalize the necessary competencies.* The creation of these "boundary actors" fulfills many of the roles of "boundary organizations" found in the literature. In terms of *convening and communication*, these actors work with elected officials, the different departments and divisions of the inter–communal structures, actors from individual *communes*, as well as experts from universities, technical bodies and consultancy companies. In addition, whether information tools are developed internally or externally, boundary actors play an important role in translating the needs of departments, political actors and the inputs of expert groups. These boundary actors have been active in developing customized methods, working with individual departments to develop tools either internally or work with external consultants as well as interface with local and regional expert groups.

b. *Second, both of the inter–communal structures have begun to establish lasting relationships with the local or regional Association agréée de surveillance de la qualité de l'air (AASQA) as well as a number of technical bodies at the regional level*. These external partners typically play a strategic role in providing the technical expertise, data and analysis needed to develop and maintain information tools and inventories. While further research is necessary, it appears that AASQAs and other regional-level technical bodies are also playing an important role in other regions.

4. POLICY RECOMMENDATIONS FOR THE FRENCH CONTEXT

As seen in Chapters 2, 3, 4, 5 and 6, analysis has led to a number of recommendations in terms of strategic orientations for policymaking and implementation. In each chapter, these strategies are broken down in each section by strategic orientations, general policy strategies applicable across institutional contexts for national and local governments and, finally, specific recommendations for France and the two cases studied. This section outlines a number of the most pressing policy recommendations for national and local decision makers in France. These recommendations focus on the actions necessary to ensure the long-term integration or "mainstreaming" of climate change and GHG mitigation into decision making.

4.1. Reducing GHG Emissions through Better Coordination of Transport and Urban Planning Policy

As seen in Chapters 2 and 3, reducing greenhouse gas emissions in the urban passenger transport sector requires a wide range of actions coordinated across the transport and urban planning sectors. Ensuring that urban development occurs in a manner that reduces the demand for mobility, along with an accompanying development of public transport infrastructures options to handle this demand, is crucial to reduce emissions. Further, both urban planning and transport policy will have a role to play in the deployment of new low-emission technologies for the inevitable continued reliance on personal vehicles. To date, the urban planning documents (PLU, PLH, SCOT) and the transport planning document, PDU, have adopted a wide range of the measures and actions necessary to encourage emission reductions. However, a number of actions still appear to be necessary to achieve GHG mitigation objectives.

At the national level, a number of modifications to the larger transport and urbanism planning frameworks are necessary to facilitate improved coordination of policy together with the integration of GHG mitigation. First, both transport and urban planning, including the PDU and the PLU, should be reassigned (when the case) through national regulation from the communal to the inter–communal level (*communauté d'agglomération, communauté urbaine*) to facilitate coordination at the most appropriate level. Nevertheless, mandates to involve individual *communes* and other stakeholders ensure the continued legitimacy and leveraging of local knowledge. Furthermore, actions are necessary to establish the coherence of the transport-planning perimeter (PTU) with the actual commuting area, although it is recognized that a balance must be found in terms of the coverage of the commuting area and increased revenues from the *versement transports*. Finally, it appears necessary to establish an enforcement and implementation body for SCOTs under the joint oversight of the concerned urban authorities and which functions at the level of the entire urban area.

Sub-nationally, while waiting for modifications in the national framework, a number of changes can be implemented to govern transport and urban planning policy at the level of the inter-communal structure. This includes the voluntary transfer of transport-infrastructure (*voirie*) and urban planning (PLU) competencies to inter–communal structures. Further, individual inter–communal structures and AOTUs can choose to federate the management of transport into a *Syndicat Mixte SRU* to extend the coherence of transport planning across adjacent territories. Finally, mechanism and contractual tools, such as the *contrats d'axe*, should be leveraged to foster coordination between transport and urban planning processes.

4.2. Improving Climate Governance: Promoting Climate Action Plans and Sectoral Integration of GHG criteria

As seen in Chapters 3 and 4, the widespread development and deployment of climate action plans has made significant progress in France over the last decade. Nevertheless, while an important step, this does not appear sufficient to integrate climate information and expertise into sectoral decision-making processes where a large number of important choices concerning medium- and long-term development pathways are made. Both national and sub-national actors must continue to identify and establish the most pertinent perimeter for action. This includes putting means of facilitating cooperation across existing institutional perimeters into place.

The current French national framework for climate change has set an implicit mandate for action through the adoption of the ambitious 2050 emission–reduction target of -75%. Nevertheless, the framework has made little progress to date in providing or identifying the necessary sources to finance national and/or local action. While sectoral financing has been available for some project-based initiatives, resources are equally necessary for local authorities to conduct the needed diagnostic studies and finance the long-term climate action–plan dynamic and implementation (staff, expertise). Steps also need to be taken in terms of integrating GHG-mitigation criteria into national sectoral financing (for example, transport infrastructure investment) to ensure coherence of objectives across sectors. While the increasing responsibility placed on sub-national actors to address climate issues must be accompanied with the financial resources and fiscal tools necessary to do so, little development has occurred in this area to date.

A number of orientations and strategies, as well as specific actions for the two cases studied in this dissertation can be identified for inter-communal structures. Local authorities must work to develop dynamic and didactic processes to coordinate the increasingly decentralized transversal actions necessary for GHG mitigation. Inter-communal structures have an important role to play to provide technical assistance to actors. In addition to work with local stakeholders, they should acquire the internal capacity to treat the subject as well as develop long-term partnerships with local technical bodies. Furthermore, the development of information and a range of GHG-measurement tools necessary to govern GHG mitigation appear fundamental. It also appears that the two inter-communal structure studies can offer each other a number of lessons. While Grenoble Alpes Métropole has worked with its various partners to establish GHG-mitigation actions, the *100 Actions* quantification process launched by Nantes Métropole could be a further means of using rough inventories to aid all departments and services to understand the impact of their actions on emission. In return, the *Charte d'engagements* model, deployed by Grenoble Alpes Métropole, offers Nantes Métropole a number of lessons in engaging and federating a variety of actor groups into the process. Additionally, Nantes Métropole must continue its efforts to develop an annual inventory to track emissions internally as well at the level of the territory.

The mainstreaming of greenhouse gas expertise into sectoral decision making must also occur. A number of changes are necessary to facilitate this at both the national and local level. Difficulties related to the integration of climate change are linked to the larger problems of integrating environmental issues in general into decision-making. As such, the national framework needs to require that the environmental evaluation begin early and continue throughout the entire planning and decision-making process. Further, increased financial and man–power resources are necessary to *préfets* charged with the analysis of these documents to ensure verification of environmental evaluations and the role of GHG information tools in a decision-making process. Local actors also have a role to play in the process through the production of more-robust scenarios within the decision-making process that should compare different combinations of policy packages to identify low-emission development pathways. Finally, steps should be taken to link the SCOT and PDU scenarios to facilitate connections between transport and urbanism.

4.3. Improving Information Tools for Decision Making: Methods, Hierarchy and Appropriation

As seen throughout this dissertation and particularly in Chapters 5 and 6, information tools and expertise on greenhouse gas emissions has an important role to play in the needed governance processes. This research has identified a number of recommendations concerning the information used to integrate GHG criteria into sectoral decision making, as well as the development of a larger "information system" or hierarchy of GHG tools geared to a range of uses.

A number of technical concerns for sectoral mainstreaming into transport decision making needs to be addressed. First, the structure of the cost–benefit analysis (CBA) applied may need to be revised to base valuation of GHG emissions on France's ambitious 2050 objectives. Currently, even with a price of 350 €/ton CO_2 (the State objective for 2050), benefits from GHG reductions for a project, such as the Line E tramway in Grenoble, remain less than 3% of total gains (see Chapter 5). As such, it appears that further reflection is needed to weigh better long-term environmental costs and short-term economic gains (time-savings) in CBA going beyond adjustments in the discount rate used. Second, little formalization of how to carry out a multi-criteria analysis has been developed and methods remain highly heterogeneous and potentially open to biases introduced by those conducting the analysis. A move towards a qualitative, multi-criteria analysis, as conducted by Nantes Métropole in the development of their 2010 PDU, could potentially pose a number of issues. This qualitative multi-criteria analysis remains relatively untested in terms of its robustness and ability to reflect potential impacts on GHG emissions accurately. As such, it appears important that the State work with the necessary stakeholders to develop a robust methodology.

The development of a larger "information system" of GHG information tools requires actions at multiple levels. At the national level, fostering GHG information–tool production may require the establishment of a mandate for all pertinent (national and sub-national) authorities to do so, whether voluntary or obligatory, coupled with the availability of resources to put initial quantification programs into effect. Similarly, the State has a role to play in providing the needed technical resources to produce the inventories by working with and recognizing the key roles of the existing actors, such as the AASQAs in France, as well as other national (ADEME) and sub-national entities. Further, the State can foster coherence across the application of GHG information tools. The production of guidelines for operational inventories, as has already been the case in France, and territorial approaches can establish the needed base definitions and methods that can be contextualized to different applications while simultaneously retaining coherence.

Local authorities, and particularly inter–communal structures in France, can foster the production, appropriation and coherence of GHG information. The credibility and legitimacy of the information produced can be ensured and enhanced through the development of an internal technical capacity on GHG quantification, whether in the form of a boundary actor or agency. Further, the development of long-term partnerships with technical–expertise organizations, such as the AASQAs, plays a role in improving the technical quality and coherence of tools. Coherence can be further assured through the adoption of national and/or regional approaches that are flexible enough to adapt to local needs. Also, the internal harmonization of basic definitions and methods across tools conducted or contracted by the inter–communal structure is an important step that both case studies need to address. Finally, fostering the appropriation of information requires that the production of GHG expertise and the results be integrated into decision-making processes in a timely fashion. This often requires that results be contextualized and linked or juxtaposed with other policy priorities to improve comprehension and acceptance by actors.

Finally, the above analysis indicates that regional actors can assist in improving the coherence and production of GHG inventories. This dissertation has identified the sharing of resources and data at the regional level in a number of locations in France on GHG-related subjects. Regional expert bodies, through either existing technical associations or State-sponsored bodies, have a role to play in assisting urban authorities with the development of their territorial GHG reporting. Further, they have the potential to be key players in assisting smaller urban and rural areas to quantify GHG emissions. These regional structures, likewise, have the potential to be a bridge in the harmonization process as they can influence the development of national guidelines and standards based on experience gained working with local actors while fostering the adoption of harmonized approaches by their partners.

5. CONCLUDING THOUGHTS AND QUESTIONS FOR FURTHER RESEARCH

The reduction of greenhouse gas emissions from anthropogenic sources represents one of the most significant collective–action problems facing humanity. Through the analysis of the French institutional context and two case studies, it appears certain that achieving a common framing, the appropriation of GHG mitigation actions and cooperation across different levels of government as well as transversally will not be an easy task. As such, the *how* of reducing GHG emissions is just as important while a continued analysis of the *what* must be done. As seen in the urban passenger transport sector in France, reducing emissions is often about doing a number of existing actions better (level, scope, coordination). Given the existing institutional structures and decision-making processes, a polycentric model of governance appears to offer a number of lessons in organizing action around a subject cutting across traditional boundaries, jurisdictions and sectoral definitions. Sub-national action on GHG mitigation is necessary in order to achieve ambitious 2050 objectives. While this analysis has indicated the usefulness of a polycentric-governance model to analyze and structure sub-national action, continued research is necessary to see whether it remains relevant.

This dissertation has also identified the increasing importance of mainstreaming climate change into individual sectoral decision-making process. While the larger climate action-plan dynamic appears important to assure that greenhouse gas mitigation becomes and remains a larger policy priority, the integration of GHG criteria into individual decision-making processes is crucial. Taken to its seemingly logical conclusion, the mainstreaming of climate change and greenhouse gas mitigation will be a means of "tempering" larger decision-making processes and, in many instances, provide the "push" necessary to move to new, low-emission development pathways. Within this process, information tools have an important role in developing a common language for discussing climate, and, thus, establishing a common framing while fostering the ability to learn from the experiences of other actors no matter the difference in approach or the practice of different sectors. As the mainstreaming of GHG criteria and indicators continue, further research is necessary to understand how this expertise can be integrated into a range of decision-making processes beyond planning documents. Lessons from existing climate and GHG "information systems" stand to offer a number of useful lessons for various decision making from financing infrastructure to managing investment portfolios. As such, further research should focus on better understanding how GHG criteria are currently being used by these diverse decision-making processes.

The scope of this dissertation and its focus solely on the French institutional context, a single policy sector and the analysis of two French case studies, limit a widespread generalization of the conclusions identified above. As such, there appears to be substantial room for further research. First, it appears necessary to take the lessons from this dissertation and analyze further cases (other urban authorities) as well as sectors (housing, industry) in France. This research has taken a descriptive approach in the hopes of serving as a basis for future comparative work while facilitating the comparison of climate governance in the French institutional context with other national frameworks. Finally, continued research will be required to identify whether the current means of governing national and sub-national greenhouse gas mitigation are sufficient to move from marginal reductions in emissions to systemic changes. This shift in scale of GHG mitigation will be necessary in order to achieve not only the 2050 emission-reduction targets, but also avert the potentially catastrophic changes in global climate that the world faces.

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ANNEXES

ANNEX 1:
INTERVIEWS CONDUCTED FOR CASE STUDIES

Case study	Name	Position	Type	Length	Date
Grenoble Alpes Métropole	Helen POIMBOEUF	Responsable Plan Environnement, La Métro	Phone interview	1:10	5 January 2010
	Stephan GUSMEROLI	direction des politiques de déplacement SMTC / La Métro	Phone interview	1:10	5 January 2010
	Helen POMBOEUF	Responsable Plan Environnement	Face to face	1:26	1 March 2010
	Stephan GUSMEROLI	direction des politiques de déplacement SMTC / La Métro	Face to face	47 min	1 March 2010
	Jérôme GRANGE	Directeur, Agence d'urbanisme de la région grenobloise	Face to face	1 :09	2 March 2010
	Murielle PEZET-KUHN	Chargée d'études environnement, AURG	Face to face	1 :34	2 March 2010
	Marie FILHOL	Directrice, Agence Local d'énergie et du climat (ALEc)	Face to face	1 :26	18 October 2010
	Jérôme BUFFIERE	Agence Local d'énergie et du climat (ALEc)	Face to face	1 :10	19 October 2010
	Geneviève GOUBEL	Agence Local d'énergie et du climat (ALEc)	Face to face	50 min	19 October 2010
	Xavier FAVROLT	Service energies et développement, Département de l'Isère	Face to face	1 :10	19 October 2010
	Patrick COINDET	Ville de Grenoble	Face to face	1 :19	19 October 2010
	Céline TAHAMAZIAN	Etablissement Publique du SCOT	Face to face	1 :51	20 October 2010
	Cyril LOUSTAU	Etablissement Publique du SCOT	Face to face	1 :51	20 October 2010
	Jean-Marc UHRY	3ème Vice-président chargé de l'environnement, du développement durable, de l'énergie et du climat ; Maire de Poisat ; Président ALEC ; Président ASCOPARG	Face to face	1 :23	20 October 2010
	Damien DENIZOT	Direction de la prospective, La Métro	Face to face	1 :20	21 October 2010
	Helen POIMBOEUF	Responsable Plan Environnement, La Métro	Face to face	1 :18	21 October 2010

	Stephan GUSMEROLI	Direction des politiques de déplacement SMTC / La Métro	Face to face	1 :03	21 October 2010
	Stephane DURAND	Ville d'Echirolles	Face to face	1 :25	22 October 2010
	David Le Bras	DPPGE - adjoint directeur de la performance, La Métro	Face to face	1 :00	22 October 2010
	Murielle PEZET-KUHN	Chargée d'études environnement, AURG	Face to face	58 min	22 October 2010
Case study	Name	Position	Type	Length	Date
Nantes Métropole	Maryline GUILLARD	Directrice, Service Animation DD Climat	Face to face	1 :35	17 February 2010
	Nicolas BOESPFLUG	Chargé de Mission DD, Ville de Nantes	Face to face	1 :00	6 December 2010
	Ameli RANTY	DG Déplacements, Nantes Métropole	Face to face	1 :47	7 December 2010
	André HERBRETEAU	DG Déplacements, Nantes Métropole	Face to face	1 :47	7 December 2010
	Damien GARRIGUE	DG Déplacements, Nantes Métropole	Face to face	1 :47	7 December 2010
	Maryline GUILLARD	Directrice, Service Animation DD Climat	Face to face	57 :00	7 December 2010
	Albin MALLET	Service Animation DD Climat	Face to face	1 :20	7 December 2010
	Vincent HURE	Service Animation DD Climat	Face to face	2 :07	8 December 2010
	Yves GOURITEN	Service Animation DD Climat	Face to face	1 :10	8 December 2010
	Tatiana LECOSSAIS	Service Animation DD Climat	Face to face	1 :10	8 December 2010
	Yan LE GAL	Directeur d'études transports, AURAN	Face to face	1 :53	8 December 2010
	Florence ALBERT	Direction Régional ADEME	Face to face	1 :50	9 December 2010
	Jonathan LEFEVRE	Service Animation DD Climat	Face to face	40 min	9 December 2010
	Alice MILITON	Air Pays de la Loire	Face to face	50 min	9 December 2010
	Luc LAVRILLEUX	Directeur, Air Pays de la Loire	Face to face	1 :10	9 December 2010
	Stéphane BOIS	Syndicat mixte du SCOT de la Métropole Nantes Saint Nazaire	Face to face	1 :19	10 December 2010
	Bernard BOURG	Ecole de Mines de Natnes	Telephone	45 min	22 November 2011
Case study	Name	Position	Type	Length	Date
Other	Regis MYER	Grand Lyon	Face to face	2:48	10 January 2010
Other	Aurélie CEVAER	GART	Face to face	1:26	8 July 2010
Other	Benjamin BUREAU	DG Tresor	Face to face	1:28	19 September 2011

ANNEX 2:
LIST OF ACRONYMS

ADEME - Agence de l'Environnement et de la Maîtrise de l'Energie

AOT – Autorité organisatrice de transports

AOTU – Autorité organisatrice de transports urbains

ASCOPARG - Association pour le contrôle et la préservation de l'air en région grenobloise

ASSQA - Association agréée de surveillance de la qualité de l'air

AURAN - l'Agence d'urbanisme de l'agglomération nantaise

AURG - L'Agence d'urbanisme de la région grenobloise

C.A. – Communauté d’agglomération

CAP – Climate action plan

CDC - Caisse des Dépôts et Consignations

CPER - Contrats de Projets Etat-Région

C.U. – Communauté urbaine

DATAR - Délégation interministérielle à l‟Aménagement du Territoire et à l‟Attractivité Régionale

DREAL - Direction Régionale de l'Environnement, de l'Aménagement et du Logement

DSP - Délégation de Service Public

DTA - Directives Territoriales d‟Aménagement

EIB - European Investment Bank, correspond à la BEI

EPCI – Etablissement Public de Coopération Intercommunale

EPF - Etablissement Public Foncier

ERR - External Rate of Return,

FDU - Fonds de Développement Urbain

ERDF - European Regional Development Fund;

GHG – greenhouse gas

JESSICA - Joint European Support for Sustainable Investment in City Areas

La Métro – Grenoble Alpes Métropole

PCET – Plan climat air énergie

PDU - Plan de Déplacements Urbains

PLH - Programme Local de l’Habitat

PLU - Plan Local d’Urbanisme

PTU – Périmètre de transports urbains

SCOT - Schéma de Cohérence Territoriale

SEMITAN - Société d'économie mixte des transports de l'agglomération nantaise

SMTC - Syndicat Mixte des Transports en Commun Agglomération Grenobloise

SRADT - Schéma Régional d’Aménagement du Territoire

SRCE - Schéma Régional de Cohérence Environnemental

SRDE - Schéma Régional de Développement Economique

SRT - Schéma Régional des Transports

ANNEX 3:
INSTITUTIONAL LEVELS IN FRANCE : VERTICAL AND HORIZONTAL ARRANGEMENTS

1. INSTITUTIONAL ARRANGEMENTS IN FRANCE[138]

While decentralization in France has increased the responsibilities and competencies of local authorities, there is no direct federalism in the structure as often found in other State-Region relationships in European countries. Table 70 describes the different levels of governance in France (*Etat, Commune, Département, Région*): in France, *there is no direct hierarchy between the different forms of local authorities* (*Communes*, Départment, *Région*). Rather, each is responsible for a set of assigned jurisdictional competencies.

1.1. Vertical Organization in France

Since the 1980s, the process of decentralization of competencies and the "deconcentration" of State authority in France has led to a rather complex institutional context involving principally three types of *collectivités territoriales* (*communes*, *départements*, *régions*). While decentralization has increased the responsibilities and competencies of local authorities, there is no direct federalism in the structure as found in other State-Region relationships in other Europe countries. As such there is no direct hierarchy between the different forms of sub-national authorities (*régions*, *départements*, *communes*), rather each has its own assigned areas of jurisdiction with representatives of the Central government (regional and departmental *préfet*) to ensure the legality of actions.

1.1.1. Central State

The current institutional model in France attempts to retain the unity of the French nation under the control of the 'State' (*Etat*) through the presence of direct representatives of the national government at the different levels. Whether regional *préfets,* departmental *préfets*, or mayors, these representatives are charged with the administration and implementation of State legislation as well as verifying in many cases that local decisions are coherent with State policy.

The *préfets* are the direct representatives of the Prime Minister and the various ministries. They have administrative powers over the police and public security. They are also charged with the management of the civil administration of the State at the local level. Additionally, a number of decentralized *Direction départementales* are found, representing the different ministries locally. The *préfet* de *région* is the *préfet* of the *département* where the regional capital is located. Since 1982, this position has become a managerial role, and is not currently seen as the hierarchical head of the departmental *préfets* within the *région*. The regional *préfet* rather coordinates actions and has no powers over administration and juridical

[138] *This annex is drawn principally from: Maryvonne Bonnard (ed) 2009. Les collectivités territoriales, La Documentation Française: Paris.*

control. The regional *préfet* is mandated to implement the national policies at the scale of the region on issues of economy, social policy and territorial development / planning

1.1.2. Communes

The *communes* are the basic unit of state and political organization in France as well as the most numerous, currently numbering over 36,600 (ranging in size from less than 100 to hundreds of thousands of residents). As is the case with other local authorities, *communes* have both specific competencies defined by national legislation as well as the ability to enact any actions that fit with the general-competencies clause of 2 March 1982. *Communes* are typically responsible for all local-scale competencies except for those explicitly delegated or attributed to other governing bodies. In terms of the deconcentration of State authority, the mayor is the direct representative of the State at the local level. This is the only case where the State representative is elected rather than appointed, however this does not limit the related responsibilities as listed in Table 70.

1.1.3. Départments

After the *communes*, the 100 *départements* are the oldest type of local authorities, created first in 1780 and gaining their administrative status in 1871. Historically the *départements* have served as an administrative circumscription, overseen by a *préfet* directly appointed by the State. Since 1982 however the *préfet* has taken an a posteriori role of approving decisions on certain issues in light of coherence with national policy. The *départements* have equally gained the status of a local authority (*collectivité territoriale*) governed by an elected general council (*conseil général*) and a president elected from their midst.

Since 1982 and the decentralization of competencies, the *département* is principally involved in the field of social policy, administering a number of aid and protection programs for children, mothers, the elderly and the handicapped. However, they are equally responsible for a number of issues in terms of education (middle schools [*college*]) and transport (non-urban bus networks, local roads as well as limited rail services). The responsibilities of the departments (as well as of the regions) can be divided in direct (*propre*) which are clearly defined by the law, and “open” (*ouverte*) responsibilities which they are able to request or accept in coordination with other local authorities.

1.1.4. Régions

The 26 *régions* are the most recent sub-national authority formally invested with the majority of their modern powers in the 1980s. As a local authority, the regions are governed by an elected regional council (*conseil régional*) with a president elected from their midst. The regional council has regulatory rather than legislative powers focusing on the development and implementation of actions in accordance with national law. At the level of the region, a clear differentiation of the competencies is difficult given the eventual sharing, co-management and regulatory competition resulting from the management of policy areas crossing multiple *départements* and a large number of *communes* as well as intercommunal structures. As the case above, there are three sources of authority: *la clause générale de* *compétence* stating that the region can take up all issues of regional importance in accordance with the law; the mandatory competencies; and a number of optional/voluntary competencies delegated from *départements* or the *communes* themselves. Principally, the regions act on issues of education (management of high-schools), higher education, professional development, economic development and territorial planning and infrastructure development.

1.2. Horizontal Governance Relationships in France: EPCIs - Etablissement public de coopération intercommunale

Demographic changes and the increasingly urbanized population has placed an increasing importance on the ability of local authorities to effectively and efficiently mange a range of policy areas and the provision of public services. France is unique among other European countries in maintaining such a large number of *communes*, *départements* and *régions* to service the given number of citizens and geographic area. In this context and given increasingly overlapping administrative boundaries, a number of formalized horizontal governance relationships have been established in France.

There are currently a number of different forms of *Etablissement public de coopération intercommunale* (EPCI) (inter-communal structures) to facilitate the coordination of activities between *communes* and other local authorities. As of January 1, 2010, there were a total of 17,944 inter-communal structures in France. EPCI are typically classified by their ability to raise their own revenues. Fiscally-dependent EPCIs are 100% financed by member *communes* and other public entities. These contributions are set within the statutes and are typically based on criteria related to the services provided. Fiscally-independent EPCIs have a broader range of revenue sources available to them and thus more independence in terms of managing their budget as well as their resulting institutional organization.

1.2.1. Fiscally dependent – the Syndicat Mixte

While a number of fiscally-dependent forms of EPCI exist, the most important for the purposes of this project is the *syndicat mixte,* based on legislation dating from 1935 and 1955. These inter-communal coordination structures bring together not only *communes*, but also include fiscally-independent EPCIs (see below) and other *collectivtés locales* and public entities. These EPCIs can be divided into to types: “closed” (*fermé*) with members from only *communes* and EPCIs; and “open” (*ouverte*), including also other public entities such as chambers of commerce, industry, agriculture, etc. These structures are dependent on members for finance and the establishment of their mission and objectives (typically addressing issues of water, waste, local development, energy, economic actions, education and culture, tourism, etc). For example, a number of local authorities have chosen to create *Sydicat Mixte* to manage urban transportation, such as Grenoble Alpes Métropole with the *Syndicat mixte de transports en commun* (SMTC).

1.2.2. Fiscally-independent EPCI

Fiscally-independent EPCI structures in France have become the most visible sign of institutionalized cooperation between *communes*. The creation of these EPCI not only transfers a number of jurisdictional competencies from the member *communes*, but also these structures can levy State-approved taxes on the populations, thus creating an additional level of taxation which allows for a measure of financial independence. In the cases of *communautés d'agglomération* and the *communautés urbaines*, the creation of these EPCI has equally led to new institutional organizations with executive bodies (president, inter-communal council) as well as the addition and fusion of administrative and technical services from the member *communes* making up the EPCI.

La Communauté de communes

The *communauté de communes* are the most numerous forms of fiscally independent EPCI structures, totaling 2,409 in 2010 and thus representing 92% of all EPCI. Further, they regroup 48% of the population (over 25.5 million) and 90% (31,220) of the *communes*. While summarized in detail in Table 70, *communautés de communes* are required to adopt two required areas of competencies: territorial development (planning) and economic development. Depending on their mode of financing, they must adopt a number of optional competencies including the environment; housing policy; physical infrastructure, cultural facilities, sports and education.

La Communauté d'agglomération

The next most numerous form of fiscally-independent EPCIs, the *communautés d'agglomération* represent 7% (181) of these types of EPCIs, and 38% (approximately 22 million people) of the population and 9% (3,101) of *communes* in these types of EPCIs. This form of inter-communality has been designed for medium-sized urban areas with a total number of inhabitations greater than 50,000 at the date of creation. Geographically, the *communauté d'agglomération* must be organized around a 'core' *commune* with more than 15,000 people. *Communautés d'agglomération* are required to assume jurisdiction over a number of competencies, including economic development, spatial planning, social housing policy, and urban social policy. The are also required to adopt three of the optional competencies, including community-wide interest infrastructure (*voirie*), sewer, water, environment, waste (solid), sport and cultural facilities. The optional competences to delegate to the EPCI are selected by the by the municipal councils. *Communautés d'agglolérations* may adopt further competencies if so desired and delegated by the member *communes*.

La Communauté urbaine

While in 2010 *communautés urbaines* represent only 1% (16) of fiscally-independent EPCIs and regroup only 1% (413) of *communes*, they regroup 13% (approximately 7,6 million people) of the population. *Communautés urbaines* have been designed as the most integrated form of inter-communal structures from which, once created, individual *communes* cannot vote to leave. Following the same geographical conditions as mentioned above, for the minimum population threshold to create a *communauté urbaine* is set at 500,000 inhabitants. It is important to note that there are two principal groupings of *commautés urbaines*: the first group made of those created before 1999, including the four unilaterally created by the central State in 1966 (Bordeuax, Lille, Lyon, Strasbourg) and those that were voluntarily created between 1966-1973 (Brest, Cherbourg, Dunkerque, Le Creusot-Montceau-Les-Mines, Le

Mans). The second group is composed of those created after 1999 (Alençon, Arras, Nancy, Nantes, Marseille). Differences exist concerning the competencies and mode of governance of the different urban communities is dependent on their date of creation.

Originally, *communautés urbaines* were designed to manage the public services used at the scale of the urban area as well as the other network services such as road/rail, transports, water and sewers. *Communautés urbaines* must assume complete control of required competencies from member *communes*. These include: economic, social and cultural development of the community; spatial planning and development; social housing policy; management of community services and facilities; and environmental protection and quality of life. Again, there is a strong integration of both competencies as well as related actions with *communautés urbaines* taking over a number of the actions held by *communes* in other forms of EPCIs, such as the granting of construction permits as well as the development of local urbanism plans (PLUs).

Table 70 : Jurisdictional Competencies of Local Authorities in France

	Région	*Département*	*Commune*
Statistics			
Number	26 total	100	36,600+ (in 1999)
Breakdown	21 - Metropolitan 1-Corsica 4 - DOM	96-metropolitan 4-Over-seas	< 700 inhabitants: 24,723 > 50,000 inhabitants: 119 > 100,000 inhabitants: 37 > 300,000 inhabitants: 5
Relation w/ State			
State Representative	*Préfet de région*	*Préfet*	*Maire* (Mayor)
Duties	- Implement national policies and regulations - Verify a posteriori the decisions made by lower levels - Coordinate actions of the other *préfets*	- Implement national policies and regulations - Oversee policy and public security - Management of civil administration and services	- Admin - Implement national policies and regulations - Organize elections - Census activities - National documents - Judicial - Civil status (marriages, births, etc)
Decentralized Agencies	- *Directions régionales* - *DREAL, etc.*	- Directions départmentales	
Governance			
	- President - Regional Council	- *Conseil général*	- Mayor - Municipal council
Competencies Principal Legislation:			
Planning and Territorial Development	- *SRADT-schéma régional d'aménagement et de développement du territoire* - Oversight of regional and local projects and coherence with national policy - Sign project contrancts - Develop CPER and CRDAT - Manage EU funds	- Rural infrastructure and material - Consultation on CPERs and the SRDAT - Aid for rural infrastructure development	
Urbanism	- Participation in development of Scots - SDRIF (il de France)	- Participation in development of Scots	- PLU (plan local d'urbanisme) - *Schémas de coherence territoriale* (ScoT) - ZAC-*Zone d'aménageent concerté* - Authorize land use

			- Building permits, etc.
Transports	- *Schema regionale d'infrastructures et des transports* - Convention SNCF - *Plan régional des transports (non-urbains)* - AOT rail (TERs) - Regional mobility services (road, rail, etc.) - Ability to request control of: ports, canals, airports	- *Plan départementale* - All non-national roadways (and some national roads since 2004) - Ocean fishing ports - Canals - Transport - Non-urban road transport (bus) - Limited rail transport (tramways, rail lignes) [in collaboration with RFF and the *communes*] - School transports, except with PTU, unless delegated by *communes*	- Infrastructures - Communal roads - Airports: - Can create and manage, however the region can take control if so desired - Ports - Creation, development and management (leisure and domestic) - Transports - Organization within the perimeter of the PTU - Urban school transports
Housing	- Establish investment priorities with the déparťs. and communes - Finance and subsidies to communes for social housing - Improve quality and energy efficiency of existing structures - Student housing in Ile de France	- Creation, management and financing of funds for social housing - Plan départemental de habitat - Schéma départemental d'accueil de gens du voyage (Roma) - Social and poor housing	- Local housing program - Social housing (delegated from département) - Management of public aid - Student housing (upon request) - Rehabilitation (on demand and condition)
Social Policy	- Medical facilities (coordination and limited finance) -	- oversees and coordinates aid to children, mothers, elderly and handicapped - Social services - Preventitive care - Manage RMI-RMA - President of the administrative council of specialized health services - Family planning	- Administer social aid programs - Analyze social needs - Child day-care and homeless shelters - Cemetaries
Education	- Professional formation and apprenticeships - Planning of school equipment and facilities - Construction and management of highschools and special education facilities - University finance and construction - Managemetn of TOS Staff	- Responsible for middle schools (colleges) - Facilities construction and management - Housing, restoration, etc. - Management of IUFMs - Professional formation and apprenticeships	- Primary and pre-schools - Ressort des écoles publiques - Recruitment for public schools - "Carte scholaire"
Economic Development	- Investment either directly or transfer of funds to other scales - Coordination of economic development by President	- Economic aide to companies - Guarantee funds	- Provide aids and subsidies, following the law - Participate in regional and national programs

	- SRDE-Schéma régionale de développement économique - Aid to enterprises / companies - CPER-Contrat de projet Etat-région - EU Structural Funds - Invest in SEMs (sociétés d'économie mixte); other funds - Tourisme - Gurantee funds		- Create an inter-communal structure - Office of tourism
Culture and Heritage	- 1% of budget reserved for investments in libraries, museums, and other cultural facilities - A number of different role for listed buildings - Archives, libraries, and regional museums - Regional inventory of cultural heritage - Organization and finance for artistic professional education - Preventative archeological digs	- Archives, libraries, and departmental museums - Artistic development and programming (music, dance, and drama) - Preventative archeological digs	- libraries and museums - municipal archives - Transfer of listed buildings on demand - Youth artistic education
International Cooperation	-	-	- Sign conventions with international local authorities in areas allowed by their competencies - Participate in an European District to manage common public services
Security	-	- Traffic police for the département - Services départementaux d'incendie et de secours	- Municipal police (Mayor) - Local council for security and anti-delinquency
Environment	- Principal orientations for the environment in SRADT - Plan régional de la qualité de l'air - Waste (industrial) - Regional natural reserves	- Elaboration and implementation of an environmental protection and use plan for sensitive natural areas - With communes, nature trails and pathways - Departmental plan for household waste treatment	- Collection and disposal of household waste - Parks? - Urban and architectural protection zones - Water distribution - Individual and collective sewage treatment

Sources: Maryvonne Bonnard (ed) (2009) Les collectivités territoriales, La Documentation Française: Paris.

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ANNEX 4: MULTILEVEL GOVERNANCE OF TRANSPORT AND URBAN PLANNING IN FRANCE

1. MULTILEVEL GOVERNANCE OF TRANSPORT AND URBAN PLANNING IN FRANCE

In France, the principal mandate for local-scale development is often linked to the difficult to translate concept of *Aménagement du territoire* or territorial development. Both a process and a result, the *aménagement du territoire* is a concept dating for the 1950s in France related to the economic and social development of the French territory, attempting to achieve an efficient and equitable distribution of population, resources and economic activity. Traditionally, this process has been highly centralized and led by the State. However, since the 1980s, a process of decentralization and development of inter-communal structures has led to the transfer of a number of both the planning and implementation competencies to local authorities. The principal legislation dictating the legal framework for urban development and transport policy has undergone significant changes since the 1980s. [139] Often, there has been what could be characterized as a "push-pull" relationship between the two issues as a desire to establish the proper territorial perimeter has been eclipsed by the desire to achieve better cross-sector coordination, and vice-versa (Offner 2002). At the heart of this has been a reformulation of institutional structures to better reflect the modern demands of urban development and transport planning

The below section will explore two of the different sectors that make up the larger process of territorial development: urban planning and transport. The multilevel institutional context within which the governing of transport and urbanism occurs will be explored through an analysis of the current legislative framework, the resulting distribution of competencies across levels and a brief analysis of financial resources. It is important to note that, as is the case for most capital cities, Paris and the Ile de France region falls outside of the legislative and regulatory structure described below (given politicization, economic weight as well as concentration of the population). A specific legal framework exists for the management of Ile de France (Paris) and is thus not treated in this chapter.

1.1. Policy Charting of Transport: decentralization and increased autonomy

1.1.1. Legislative Framework

The principal legislation defining modern transport policy in France dates from 1982

[139] The election of François Miterand in 1981 marked the beginning of an intense period of action on the decentralization of authority and competencies to sub-national authorities. Making true on this election promises and a campaign based around expanding local administrative powers, President Miterand's Administration created much of the institutional framework that is still relevant today. Between 1982 and 1985 – over 40 laws and 300 decrees treating a wide range of subjects: competencies, repartition of public resources, electoral rules and positions, modes of cooperation between local bodies and the development of participatory governance.

with the "*loi d'orientation sur les transports intérieurs* "(LOTI). Part of a larger decentralization process, the law assigns the responsibility for different transport competences and modes to different forms of local authorities (*régions, départements, communes*, etc.) defining different local authorities as the *Autorités Organisatrices de Transports* (AOT)[140] for rail, rural and urban transport services. This legislation also laid out the concept of the organization of transports as a *public service*, establishing a number of guiding missions for national system, carried out between the State and the AOT's in partnership with private and public companies (Article 5) most notably including: the construction and management of grade-separated public transport infrastructure and equipment; the development of information on the transport system; and the organization of public transport. Above all, this legislation introduced the priority of developing and favoring the use of transport alternatives to the use of personal vehicles.

While little has changed in terms of the organizational tenants and objectives laid out by the law LOTI in 1982, "*La Loi sur l'air et l'utilisation rationnelle de l'énergie du 30 décembre 1996*" (LAURE) responded to growing concern about energy use and local air pollution in the 1990s. As such, the LAURE legislation rendered obligatory the development of the *Plan de déplacements urbains* (PDU) for urban areas over 100,000 residents as well as furthered the sharing of roadways by different modes. In 2000, the legislative framework further evolved with "*La loi Solidarité et Renouvellement Urbains*" (SRU). While of greater impact for the *Code de l'ubanisme*, the SRU law also introduced a number of elements terms of transport policy. Most notably, the SRU attempted to increase the connections between transport and urbanism through the reinforcement of the role of the PDU across the entire urban area and requiring that individual PLU documents must be in coherence.[141] Most recently, the *Grenelle de l'environnement* and the resulting legislation passed in 2010 has placed a formal emphasis on reducing GHG emissions from all sectors (-20% of 1990 levels by 2020). Additionally, this legislation has further emphasized the development of public transport services through a number of changes in the tax code, minor clarification of jurisdictional competencies concerning different modes as well as ability for local authorities to experiment with city-center tolls systems.

1.1.2. Distribution of Competencies across levels: a tri-partite division of responsibility

The above legal framework has assigned the responsibility for the organization of different parts of the transport network to different levels of government. As illustrated in Table 71, the jurisdictional competencies concerning transport are distributed between the *State, the Régions, Départments and Communes* (including the inter-communal structures). At

[140] Entities charged with the organization and management of transportation services within a defined perimeter.

[141] Thus, planning documents are required to study the impacts of urban development on traffic flows and prioritize development in those areas served by public forms of transportation. This legislation also allows for the creation of Syndicat Mixte SRU or Syndicat Mixte de Transport between multiple AOTs from different levels of government and different inter-communal structures to better coordinate transport policy across the entire urban area.

all scales, the operation of the public transports networks are often delegated through concession contracts to either private and mixed-economy companies.

Table 71 : Distribution of Transport Competencies

	State	*Région*	*Département*	*Commune* & EPCI
AOT	- Inter-regional rail, high-speed rail (TGV)	- Regional road and rail (TER)	- Non-urban road (buses, etc.)	- Urban (AOTU)
Infrastructure	- National roads and railways		- Departmental roads - Portion of national roads	- Communal roads - Urban public transport
Planning Documents	- *Schéma national des infrastructures de transports*	- *Schéma régional des infrastructures et des transports* (SRADT)	- *Schéma départemental de transports* (SDDT)	- *Plan de déplacements urbains* (PDU)

The State sets the majority of the rules and regulations concerning transport in terms of social policy and the environment. Thus, the representatives of the State at the different levels are charged with the application and oversight of this regulation. The State is equally responsible for the organization of transports of national interest, including the inter-regional rail and national road infrastructures, the TGV lines and controlled-access highways. The Régions are in turn responsible for transports of regional interest and, since the SRU law in 2000, responsible for the organization of the regional rail transport (TER) services. Further, the Régions are charged with the development of the *Schéma Régional des Infrastructuers et des Transports* which must be taken into consideration (but not conformed to) in the development of SCOTs, PDUs and other related planning documents (described further below).

The Départments are responsible for the transports of departmental interest, particularly those in suburban and rural areas. They are principally charged with the *routes départementals* and a portion of the *routes nationales* since 2004. They are also responsible for the organization of non-urban road transport (bus) service between urban areas. Finally, at the most “local” level, the communes or the inter-communal structures are charged with the organization of urban transports. All intercommunal structures, except communautés de communes, are required to take up the transport competency. They can either manage this themselves, or delegate responsibility to a *syndicat mixte*, the organization and implementation of transportation services with an officially-established perimeter (PTU). The communes are equally responsible for the communal roadways as well as the infrastructure related to public transport, such as tramway rail lines, etc.

1.1.3. Transport Finances

The financing of transport infrastructures and public transport in France stems from a number of different sources, including: the *versement transports*; tariff revenues; different subsidies; *Dotations*; and debt (see Table 72). A particularity of the French system and by far the largest source of financing for both transport operations as well as investment comes from the *versement transports*, a tax paid by local businesses larger than nine employees based on total payroll in urban areas with over 10,000 residents. Collected by the EPCI and managed by the AOTU, this block of funding has given The second specificity to the French context is are national transfers, or *Dotations* from the central State to local authorities to cover a portion of the costs of implementing the responsibilities delegated through the decentralization process. While these transfers may make up a significant portion of the budget for other policy sectors, they represent only a relatively small amount of fund for transport development outside of Ile de France (Paris) in France.

Table 72 : Financing of urban passenger transport (operations and investment) outside of Ile de France 2000-2002 (in Million Euros)

	2000		**2002**	
Ticket Revenues	703	16.4%	712	17.4%
Versement Transport	1,696	39.6%	1,844	45%
Local Budget	723	16.9%	716	17.5%
State Transfers (État)	291	6.8%	172	4.2%
Other (debt included)	868	20.3%	651	15.9%
Total	4,281	100%	4,094	100%

Source: Cour des comptes 2005:143

1.2. Policy Charting of Urbanism: increasing scope and relevance of territorial planning

1.2.1. Legislative Framework

Legislation and regulations concerning urbanism in France are grouped together in what is called *Code de l'Urbanisme*. Initially created in 1954 in its present form, it lays out the objectives, distribution of competencies, regulations and processes corresponding to urban development. Within the Code, the objectives that the various planning tools and documents must respect are also outlined (*Article L. 121-1*), including :

1. The balance between urban renewal, control growth and development, the development of rural areas on one had, and the preservation of agricultural and forestry areas as well as the protection of natural zones, landscapes and a respect for sustainable development objectives.
2. The diversity of urban functions and social mix in urban and rural housing… taking particular account of the balance between employment and housing and transportation and water management
3. An efficient and balanced use of natural, urban, suburban and rural spaces, controlling the needs of mobility and traffic, preservation of clean air, water, soil and subsoil, ecosystems, green spaces, environments, sites and natural or urban landscapes, reducing noise pollution, the safeguarding of heritage and noteworthy urban districts, prevention of foreseeable natural, technological hazards, pollution and nuisance of any kind.

Since the mandating of the development of the original *schéma directeur* planning documents in 1967, a number of significant pieces of legislation have influenced the Code de l'urbanisme in France. Firstly, the *Loi du 25 juin 1999 d'orientation pour l'aménagement et le développement durable du territoire* (LOADDT) aimed to increase democratic participation in the planning process as well as introduce a number of sustainable development criteria and objectives. One of its principal changes was the creation of the ability for a "conseil de développement" to be established in each inter-communal structures as an advisory body on development and planning issues. Focusing principally on the regional or infra-regional scale, the law further mandates the development of a number of different planning documents and tools meant to coordinate development across urban areas, setting the principal guidelines and objectives in over the medium-term.[142]

Secondly, the *loi relative à la solidarité et au renouvellement urbains* (SRU) adopted in 2000 under the government of Lionel Jospin, greatly modified the *Code d'urbanisme* in terms of planning and housing. In terms of planning, the law led to the replacement of the *Schema Directeurs* (SD) with the *Schémas de cohérence territoriale* (SCOT) planning documents. The *Plan d'occupation de sols* (POS) land use plans were equally replaced with the current *Plans Local d'Urbanisme* (PLU). Further, a number of actions were taken in terms of institutionalizing sustainable development objectives and production concrete actions. This has included incentives to reduce consumption of non-urbanized areas and urban sprawl through the promotion of increased density in already urbanized areas (limiting the possibility of setting a minimum size for building lots, allowing subdivision of land outside of subdivisions). This law served to put into the place the majority of the current planning and regulatory systems in terms of urban planning.

Finally, the *Grenelle de l'environnement*, approved in 2010, will have a number of yet to be felt effects. It has modified the *Code de l'ubanisme* in order to further mandate the integration of environmental concerns and formalizing them in planning objectives .The new wording of the founding principles of planning documents (Article L 121-1 of the *Code de l'Urbanisme*, Article 14 of the Act) specifies the sustainable development objectives the reduction of greenhouse gas emissions, energy efficiency, expansion of renewable energy sources among others. These objectives must be taken into consideration (although no quantified objectives are given) within future, "re-enforced versions" of the *Schémas de coherence territoriale* (SCOT) as well as the *Plans Locaux d'urbanisme* (PLU).

1.2.2. Distribution of Competencies across levels: significant control by the communes

Given that the process of urban development and planning includes a large number of choices, from the construction of public facilities to the private housing developments, it can be difficult to clearly chart the distribution of the competences related to urban planning and the larger process of *aménagement*. However, as shown in Table 73, a number of responsibilities for both actions and planning documents are delegated to specific authorities.

[142] These include : the *Schémas régionaux d'aménagement et de développement du territoire* (SRADDT), the *Schémas de services collectifs* (SSC), the *pPofil environnemental regional* and the *Directives territoriales d'aménagement* (DTA).

Table 73: Distribution of Urban-Planning Competencies

<table>
<tr><th></th><th>State</th><th>Region</th><th>Department</th><th>Commune & EPCI</th></tr>
<tr><td>Division of responsibility</td><td>- Projet d'intérêt général
- Opération d'intérêt général
- - Directives territoriales d'aménagement</td><td>- Oversight of coherence with national policy
- Development contracts
- EU structural funds</td><td>- Rural infrastructure and material</td><td>- Authorize land use, building permits*
- ZAC-Zone d'aménagement concerté</td></tr>
<tr><td rowspan="2">Planning Documents</td><td rowspan="2">- Verification of legality of planning documents (SCOT, PLU, etc;) through préfets</td><td>- Schéma régional d'aménagement et de développement du territoire (SRADT)</td><td></td><td>- Plan local d'urbanisme (PLU)*
- Plan local de l'habitat (PLH)</td></tr>
<tr><td colspan="3">- Schéma de cohérence territoriale (ScoT)</td></tr>
<tr><td colspan="5">* The authorization of land use, building permits as well as the PLU remains under the direct control of the mayor unless delegated to the EPCI. The only exceptions are in the case of the PLUs of the early communauté urbaines of Bordeaux, Lille, Lyon and Strasbourg, which are directly under the control of the urban community government.</td></tr>
</table>

While the State, *Région* and *Département* are involved in the development of a limited number of projects typically related to national interests, State-Region development contracts or those funded by European Structural Funds, the communes in France retain the majority of control over decisions concerning land use, building permits and operational urbanism. In the majority of instances, even when communes are engaged in an intercommunal structure (EPCI) they continue to have direct control over the *Plan local d'urbanisme*, the only legally binding urban planning document[143]. The responsibility for the elaboration of the *Schémas de coherence territoriale* (SCOT) falls upon the Regions, Departments and the Communes/EPCI as its development is led by an agency headed by representatives from all involved parties (*Etablissement publique / Syndicat Mixte*). The State is involved through the initial validation of the perimeter of the SCOT as well as through a final validation in terms of its legality by the corresponding *préfet*.

1.2.3. Urbanism Finances: highly diverse public and private sources

The financing of urban planning and development is equally complex, combining a number of public and private sources. In addition to the financing invested by private developers in residential and commercial projects, there are a number of public sources of finance. A large number of infrastructure investments fall under the categories of specific policy tracks (health, education, transport, public housing, etc.) for which there is a dedicated budget. Nevertheless, a number of financing and subsidy programs exist, either through the

[143] It is important to note that in a number of instances (communauté urbaine created before the SRU) or when specifically delegated, the PLU may be elaborated by the intercommunal structure. However, the PLU continues to be principally elaborated by the individual communes with, when available, assistance from other (intercommunal, etc.) structures.

auspices of the European Union and the different structural funds (ERDF, JESSICA[144]) or through the French State, such as the development of *Contrats de Plan Etat-Region*[145] and *Contrats de Ville*. These competitive project-based programs however are limited in scope and thus provide funding to only a relatively small number of projects. Local authorities also have historically had access to a number of local taxes to allow them to leverage financing, such as the *taxe foncière sur les propriétés bâties*, representing 30% of local revenues, levied on owners of constructed properties and the *taxe foncière sur les propriétés non bâties* less than 2% of tax revenues, it is levied on un-built properties (Bonnard 2009). However it is unclear what portion of these different taxes serve to finance the operations of the local authority and what portion are re-invested into urban development projects.

1.3. Additional Actors in Transport and Urbanism: provision of technical assistance

In addition to the State, the Régions, the Départements and the Communes, a number of other actors are involved in both transport and urbanism. These bodies assist national and local authorities in the development of planning documents, projects, as well as socio-economic and environmental evaluations.

At the national level, a number of centralized agencies and ministerial bodies are involved in transport and urban planning: DGITM - *direction générale des infrastructures, des transports et de la mer*; CERTU - *Centre d'études sur les réseaux, les transports, l'urbanisme et les constructions publiques*; ADEME – *Agence de l'environnement et la maitrise de l'energie*[146]; DATAR - *Délégation interministérielle à l'aménagement du territoire et à l'attractivité régionale.*[147]

Secondly, a number of "decentralized" bodies have been created to provide technical support to local authorities in the development of plans and projects, including: CETE – *Centres d'études techniques de l'Équipement* (8 interregional centers); DREAL– *directions régionales de l'environnement, de l'aménagement et du logement*.

Finally, a number of non-governmental and private entities are equally involved including: Urban planning agencies (*Agence d'urbanismes*); AASQA - *associations agréées de surveillance de la qualité de l'air*[148]; Private companies – consultancies (studies, transport

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[144] ERDF- European Regional Development Fund; JESSICA - Joint European Support for Sustainable Investment in City Areas

[145] A *Conrat de Plan Etat-Region* is a document by which the State and Region commit to a programmed multi-year funding of projects such as building infrastructure or development of new industries in a given territory.

[146] N.B. The ADEME has both a centralized and decentralized presence with National offices as well as Regional Directions present in the Régions who work directly with the *collectivités*. The D.R. also play a role in the CPERs established between the central government and the regions.

[147] The DATAR is the French administration responsible for preparing guidelines and implementing national policy on land-use and development planning. It is particularly involved in the implementation of decisions adopted by the *Comité interministériel d'aménagement et de développement du territoire* (CIADT).

[148] The AASQUAs are often active in the collection of data on the atmospheric pollution stemming from transport and other sources.

and urbanism plans); Operators – public / mixed / private; Developers - public / mixed / private.

1.4. Strategy & Planning Documents: le mille feuille administratif

A principal component of transport and urban planning policy in France is an interrelated system of statutory and strategic plans. Together, these documents aim to establish a “unified” approach, theoretically coordinated by the principal directives set forth in the *SCOT* document developed at the scale of the urban area (*aire urbaine*). These documents attempt to balance the overarching priorities of sustainable development including economic, social and environmental elements while at the same time encouraging citizen participation in their development and implementation. It should be noted that these different documents do not necessarily represent a linear development (*SCOT* -> PDU -> PLU -> PLH) as they have been created and implemented at different moments in time and require different approval processes that can introduce delays, etc. While rational in its approach, this system has been named the *mille feuille administratif* due to the resulting mass of strategic documents and the difficulties often encountered in their coordination and implementation.

Urbanism: SCOT, PLU, PLH

As seen in Figure 24, the two principal planning documents in terms of urbanism are the *schémas de cohérence territoriale* (SCOT), *the plan local d'urbanism* (PLU). These two documents have a strategic importance for the territory within their boundaries, setting the development priorities and principal objectives. However, they have two very different roles that must be kept in mind.

The SCOT is developed at the scale of an entire territory / metropolitan area and is used to establish a shared vision between the different local authorities (principally communes and the different intercommunal structures). The principal role of the SCOT is to coordinate and ensure a certain level of coherence between the different communal and sectoral planning documents (PLU, PDU etc.), focusing specifically on urbanism, transport, housing and the localization of commercial facilities. Spanning multiple years, the SCOT is elaborated by the public authorities present within its (highly political) circumscription, often leading to the creation of a separate agency (*sydicat mixte* or *etablissement publique*) charged with its elaboration. The SCOT lays down the general principles of spatial organization and restructuring of the urban area and is used to determine the overall balance between urbanized areas, wildlands and agricultural and forestry. Further, the documents serves to establish a certain number of over-arching objectives in terms of housing and social housing, urbanization and public transport, the protection of landscapes, as well as risk prevention. In doing so, the SCOT must conform with a number of regional and national planning documents and regulation, including la *Loi montagne* or *la Loi littoral, the Schéma regional d'aménagement et de développement du territoire* (SRADT), etc.

The *plan local d'urbanisme* (PLU) sets the specific objectives and regulations in terms of land use at the level of the commune. While it must be coherent with the SCOT, the PLU formalizes land-use regulations and other details of the operational development practices. It serves as the only *legally-binding*[149] reference for land use, project approval and the subsequent issuance of building and demolition permits. Combined with land-use plans, the PLUs are the principal tools for the implementation of urban policies at the commune and inter-communal level. They provide a common framework for the various activities and operations, public or private, and should help ensure the coherence as well as positive diversity of urban functions. Since 2000 and through the PLU, the economic social and environmental objectives of sustainable development are to be at the center of the planning process. An emphasis has been placed on the development of the city as to consume less space, produce less pollution and be more socially cohesive.

The third document directly influencing urban development is the *programme local de l'habitat* (PLH). This document outlines the principal objectives in terms of the development of housing in the urban area. Elaborated by and at the scale of the different EPCI (communautés d'agglomération and communautés urbaines), the document must respect the quantified objectives in terms of housing development established by the *SCOT* as well as take into consideration the objectives outlined in the PDU (see below). Finally, the PLU must take into consideration the objectives and actions outlined in the PLH.

Transport: Plan de déplacements urbains

While the above documents do address transport-related issues, particularly the *SCOT* which must analyze impacts of territorial development patterns in terms of transport demand, it is the ***plan de déplacements urbains*** (PDU) that principally addresses issue of urban transport. The PDU was established by the LOTI legislation of 1982 and subsequently detailed with the LAURE (1996) and SRU (2000) legislation with an added emphasis on its coherence with the larger urban development. Elaborated for a period of 10 years, a PDU is the planning document and tool to organize the passenger transport and freight traffic and parking within an officially recognized perimeter (PTU)[150]. The objectives of the PDU include improving the safety of all trips, reducing personal vehicle traffic, and the organization of parking. Further, since 1996, the document is charged with promoting cleaner and energy efficient modes. PDUs are statutory for urban areas larger than 100,000 residents and are developed by the Autorité Organisatrice des Transports Urbains (AOTU - *Urban Transport Organizing Authorities*), typically the inter-communal structure that is vested with the competency for urban transport. In 2008, 72 urban areas with populations above 100,000 residents are required to produce PDUs with an additional 43 choosing to do so voluntarily (GART 2010).

The PDU establishes the guidelines and objectives concerning mobility and mobility services. The PDU must be compliant with the SCOT. Given that the PLU establishes the specific regulations concerning parking, construction, which can have an influence on the

[149] While there is a legal obligation to produce the other documents, such as the *SCOT*, PLH, etc., the PLU is the only legally binding document that can be used to contest the granting of different building permits, etc., in a court of law.

[150] The scope of the *Perimetre de transports urbains* is established at the scale of the the organising entity (commune, inter-communal structure, sydicat mixte) and approved by the préfet.

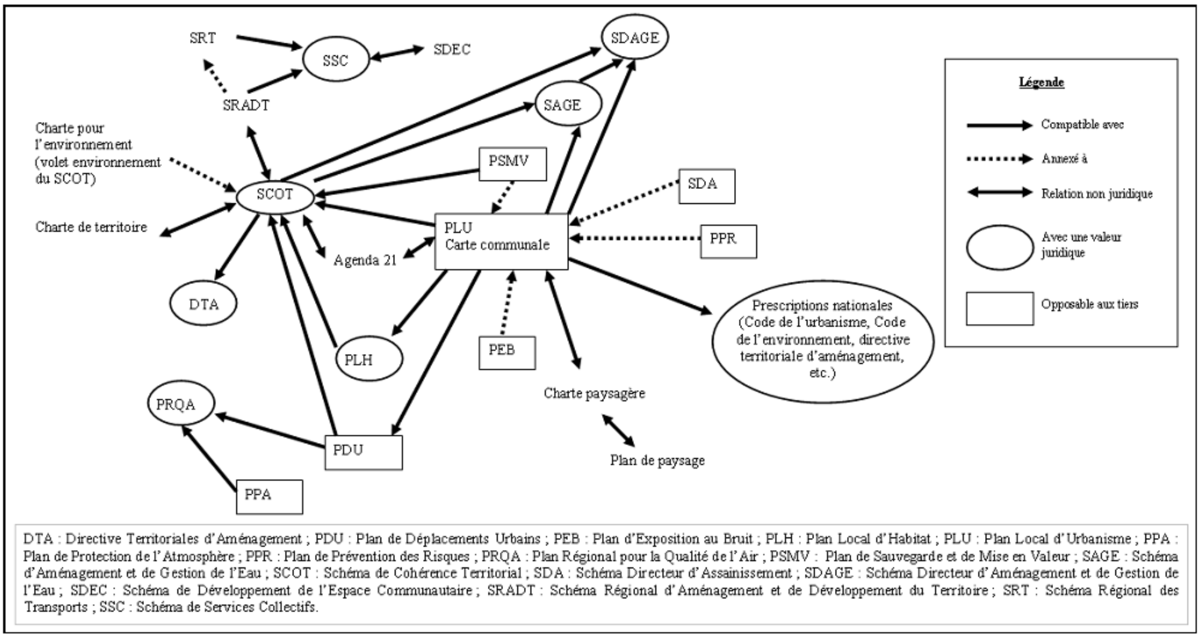
demand for and supply of mobility and transport services, it must be coherent with the PDU and the objectives set out within it. The PDU must be evaluated after 5 years.

Compatibility, Coherence and Other Planning Documents

Part of the planning culture of the "mille feuilles" (thousand layers), the above strategy and planning documents make up only a small portion of the larger framework of planning documents. As seen in Figure 24, the *SCOT*, PLU, PLH and PDU have a complex relationship with the various other statutory and voluntary planning and orientation documents in France. While a full description of these documents is beyond the scope of this chapter, the most important documents that must be taken into consideration are the following:

- *Plan Régional pour la Qualité de l'Air* (PRQA) – developed by the regional councils to steer the process of limiting air pollution. The PDU must take this into consideration.
- *Schéma Régional d'Aménagement et de Développement du Territoire* – developed and approved at the regional level by the regional council in partnership with the public and private stakeholders.
- *Schéma régional des infrastructues et des transport* – developed at the regional level to coordinate transportation services across different actors and competent authorities.

Figure 24 : Relationships between planning documents in France

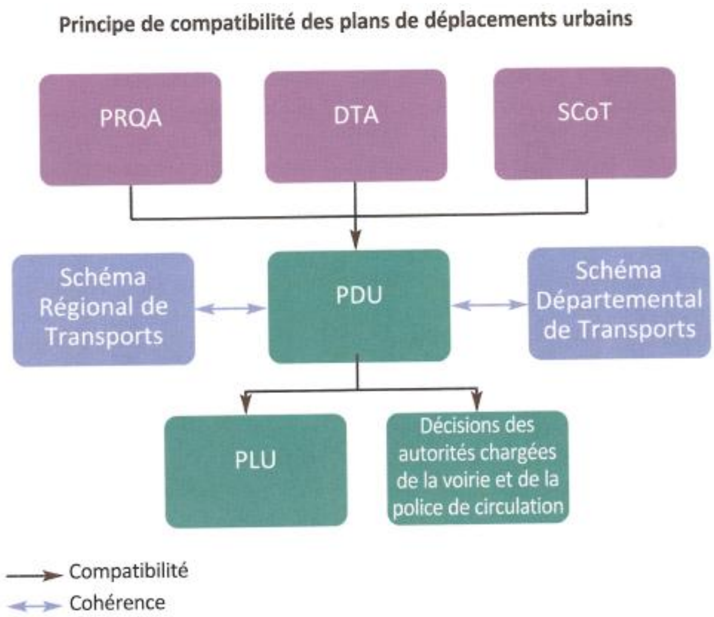


Source : Colombert 2008

A final point important to understand the relationship between the planning documents are the legal concepts of *compatibilité* and *cohérance*. In French legal terminology, the requirement for documents to be "cohérent" implies that the documents must implement similar planning practices, however one document does not impose itself on the other. "Compatibilité" however, requires that the other documents comply with the norms and standards set out in the over-arching document. Figure 25 demonstrates what this means in terms of the PDU, which must be coherent with a number of documents, including the

Schéma Régional and Départemental de Transports. It must, however, comply ("compatibilité) with the guidelines, norms and objectives laid out in the *Plan Régional de protection de l'atmosphere (PRQA), the Directives territoriales de l'aménagement (DTA)* and the *SCOT*. Further, a number of documents must comply with the PDU, including the PLU and the decisions made by the different authorities charged with transport infrastructures and the traffic police.

Figure 25 : Links between PDU and Other Planning Documents



Source: GART 2010

ANNEX 5:
TRANSPORT DECISION-MAKING PROCESS IN FRANCE

2. TRANSPORT DECISION-MAKING PROCESS

Urban passenger transport planning and decision-making in France can conceptually be divided into two separate, but linked and often concordant, processes. The first involves the development of strategic planning documents related to transport and urbanism, such as the *Plan de Déplacements Urbains* (PDU)[151], the *Schémas de Cohérence Territoriale* (SCOT)[152], or the smaller-scale documents, such as the *Plan Local d'Urbanisme* (PLU) and *Plan Local de l'Habitat* (PLH). The formal development of these planning documents typically spans multiple years, integrating a wide range of actors from different sectors as well as different levels of government to identify and articulate the medium- and long-term development pathways for the given jurisdiction. The second process involves the translation of these strategic actions and orientations developed within the planning documents into specific projects. The decision-making process surround the development of projects does not call the PDU-approved project itself into question, but rather considers the final operational structure and technical details.

This annex focuses on the processes surrounding the development of the *Plan de déplacements urbains*, the principal urban transport planning document, and the translation of the objectives into individual transport-related projects. As seen in Figure 26, the transport decision making process in France is characterized by two principal processes. The strategic mandates outlined in the *Schéma de coherence territorial*, (SCOT) establish the larger development guidelines for the territory. These elements feed into the development of the PDU, which establishes the strategy and plan of actions within the urban area for the next five to ten years. Once projects are approved within the PDU, a second decision-making process occurs surrounding their technical structure and implementation, and eventually, their construction.[153] Both stages of policy development are subject to public inquiry as well as an environmental evaluation described below.

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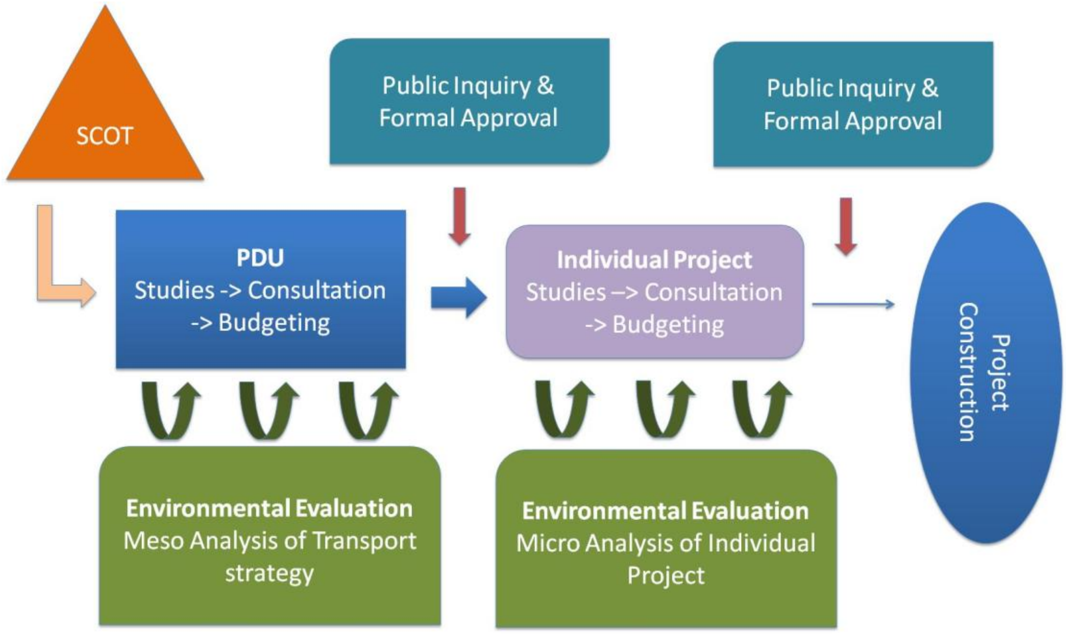
[151] Since the *Loi d'orientation des transports intérieurs* (LOTI) legislation in 1982 (and subsequently detailed by the LAURE legislation in 1996 and the SRU in 2000) urban areas over 100,000 inhabitants have the statutory obligation to develop a *Plan de Déplacements Urbains* (PDU). Established for a period of 10 years, a PDU is the planning document and tool to organize the passenger transport and freight traffic and parking within a given perimeter (PTU). The objectives of the PDU include improving the safety of all trips, reducing personal vehicle traffic, and the organization of parking.

[152] The *schémas de cohérence territoriale* (SCOT) were established in 2000 by the *Loi SRU (solidarité et renouvellement urbain*) and lays down the general principles of spatial organization and restructuring of the urban area and is used to determine the overall balance between urbanized areas, wildlands and agricultural and forestry. Further, the documents serves to establish a certain number of over-arching objectives in terms of housing and social housing, urbanization and public transport, the protection of landscapes, as well as risk prevention.

[153] It should be noted, however, that projects can be characterized of existing independently of the PDU documents, often predating not only the requirement itself, but in some instances the obligation to produce a PDU in general.

Figure 26: Cycle of urban transport decision-making in France



Source: author

2.1. Decision-making: the Plan de déplacements urbains

The legal framework for the development of the PDU established by the French State leaves the structure of the process up to the *autorité organisatrice de transports urbains* (AOTU – see Chapter 3 and Annex 4) charged with managing the process. While the State does not formally define the stages of development of the PDU, it has put forwards a number of guidelines which aim to 'streamline' the process (CERTU/CETE 2007). A simplified diagram of the steps in this process are presented in Figure 27, including: identification of principal issues and framing of the process; initial diagnostic study; establish draft objectives and defining the terms of reference (for studies, contracting, etc.); completion of analysis and diagnostic; formalization of objectives; elaboration and comparison of scenarios; choice of scenarios and definition of the global strategy; elaboration and finalization of PDU proposal. At the end of these various steps, a draft PDU should include proposals for action at various levels (infrastructure, organization of transport supply, regulation, traffic control, pricing, communication), as well as the integration of all modes of transport and parking, transportation and deliveries of goods. At this stage, proposals for financial programming and simulations be included as well as an assessment assuring the consistency with the established objectives.

2.1.1. Environmental Evaluation

The PDU are subject to a statutory environmental evaluation resulting from the French transposition of Directive 2001/42/EC of 27 June 2001 on the assessment of the effects of certain plans and programs on the environment. The process should in theory be iterative and accompany the entire development of the PDU. The strategic environmental evaluation of planning documents and programs is a process that aims to assess the implications and challenges of public decisions on the environment. A final report must be developed by the AOTU to identify, describe and assess the likely impacts of the implementation of the draft PDU on the environment with several procedural objectives, including:

- Establish a thorough understanding of the territory in question and document the initial state of the environment and its evolution
- Ensure the appropriateness of choices made through a measuring of impacts and regularly testing for consistency with environmental objectives,
- Inform citizens about the issues and results of policies implemented.

This information is to be used not only to improve the plan by comparing different alternatives, but also to encourage participation and public information. As translated into the French legal code from the EU Directive, the role of environmental assessment is not to penalize a plan or program, but rather as a tool to be used in its elaboration with the goal of anticipating effects on the environment and improve the project. The environmental assessment is to occur throughout the development process and culminate in a statutory impact study that identifies, describes and assesses the significant effects on the environment that may result from plan or project. This report presents the measures planned to reduce and, wherever possible, prevent negative effects on the environment. It describes the alternatives considered and the reasons why, especially in terms of protecting the environment, the project has been selected. As seen in Figure 26 and Figure 27, it is recommended that the environmental evaluation process occur parallel to the entire development of both planning documents and project. This process can take the form of initial impact studies, working groups, etc. However, as defined in *section A. 122-3* of the French Code of the environment, the principal objective of the environmental evaluation is the production of the environmental impact study.

Once the study is finalized and approved by the competent decision-making body[154], it is submitted to the *environmental authority*[155] for review. The environmental authority has 2 to 3 months to conduct its review, depending on the type of evaluation, starting from the date of reception. The document is considered approved if the review is not completed within the given time period. The opinion of the environmental authority should address both the quality of the analysis and how the environment is taken into account in the project. It comprises an analysis of the project, an analysis of the completeness of the impact study, including the quality and appropriateness of the information it contains, and an analysis of the consideration of the environment in the project, including the appropriateness and adequacy of measures to avoid, reduce or offset impacts. The opinions expressed by the environmental authority and information relating to a notice must be made public electronically on its website.

[154] This *competent authority* is charged with the licensing decision, approval or execution of a plan or project, eg. the mayor, a local authority, or AOTU etc

[155] The *environmental authority* is charged with assessing the consideration of environmental issues in the project and issue an opinion structured to inform the statutory public inquiry process. In the case of projects led by local authorities, the relevant environmental authority *préfet de région*. In the case of plans and programs, the applicable environmental authority is the *préfet de département*.

2.1.2. Public Consultations and Public Inquiry

The widespread inclusion of public participation in decision-making has occurred relatively recently in France and as such continues to remain relatively limited in scope. Following a growing critique and the identification of a lack of representative democracy concerning particularly the development and environmental impacts of transport infrastructure, the early 1980s saw a generalized increase in the role of the public in the decision making process (Damart & Roy 2009). As see in Figure 27, once approved by the AOTU, the draft PDU must pass through a period of public inquiry and consultation. Firstly, the draft PDU must be submitted for review to municipal councils, general and regional actors and the prefects for a response within three months. During this process, the AOTU seeks the expert opinion of the State (through the *préfet* and the decentralized service) concerning the draft PDU's consistency with national guidelines and other planning documents (SCOT, etc.). The *préfet* must judge the quality of the environmental report attached to the draft PDU and how is taken into account the environment in this project (described further below) as well as indicate the conformity of the national legislation.[156] Equally, the AOTU, if requested, is obliged to consult with representatives of the professions and public transport users as well as associations representing people with disabilities or reduced mobility, chambers of commerce and industry associations as well as recognized (*agréée*) environmental groups.

Following the consultation period, a formal public inquiry begins of the draft PDU as it was adopted by the AOTUs. A large range of documents are required to be presented to the general public, including the draft PDU, the environmental report, the public opinion of participants in the formal consultation and the laws governing the public inquiry. Once the consultation and public inquiry period has terminated it is expected, although there is no legal obligation, that the draft PDU be modified to reflect the results of the public inquiry. Further, the draft document must take into consideration the response of the *préfet* concerning the environmental report and make any necessary changes. However it is important to note that if significant changes are made to the PDU, it may be necessary to update the environmental evaluation and repeat the public inquiry process. Once any modifications have been finalized, the executive body of the AOTU can legally approve the final PDU, at which time it becomes legally enforceable against private individuals and public entities.

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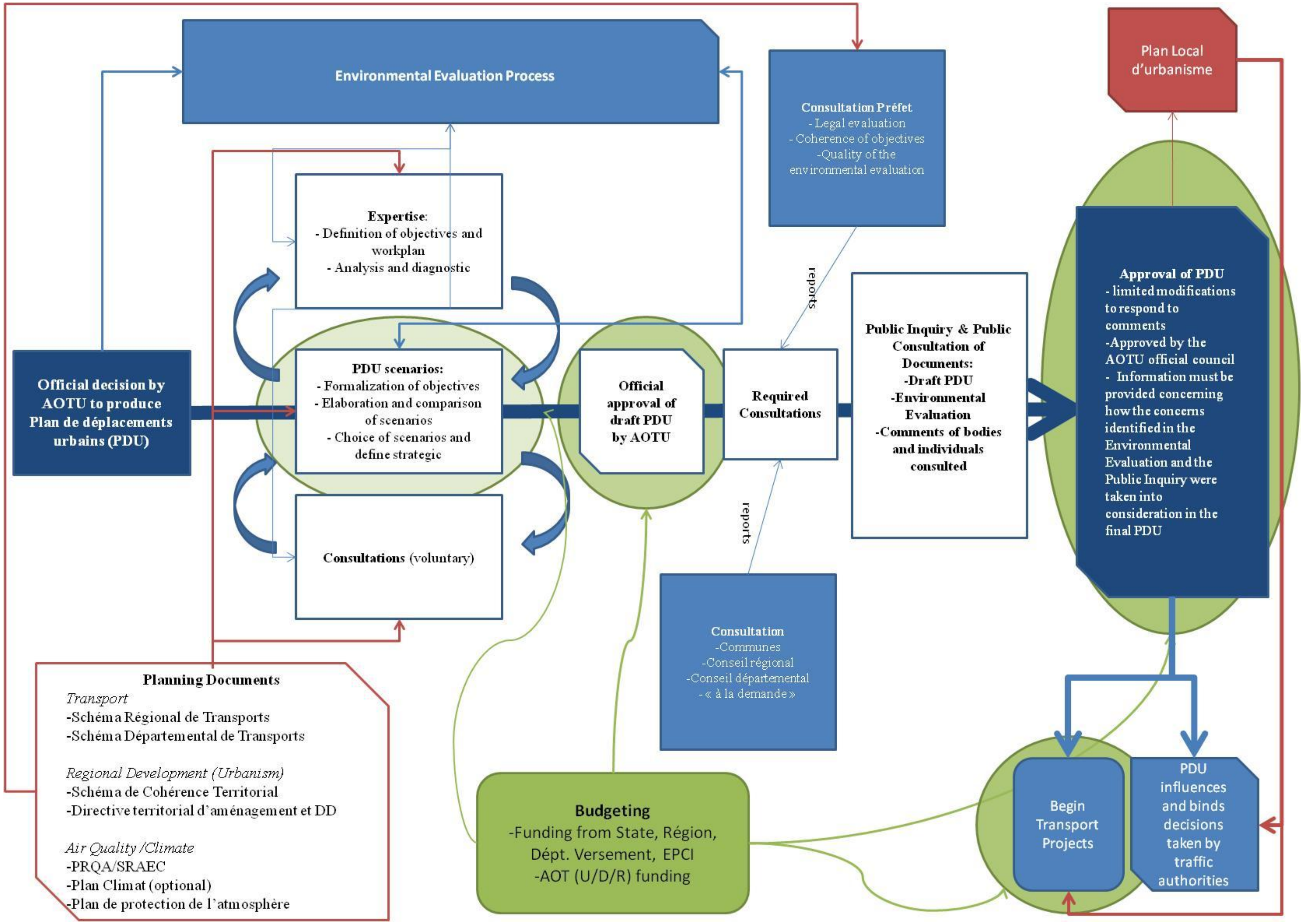
[156] It is important to note, however that while public consultations are necessary, the AOTU is not obligated follow the submitted opinions. However, the fact of not following a negative opinion can still have adverse consequences on the draft PDU. Indeed, these notices are attached to this project subject to public inquiry, they can influence the investigating commissioner and push if necessary to make an unfavorable opinion. (CERTU/CETE 2007)

Figure 27: Detailed PDU Decision-Making and Approval Process in France



2.2. *Individual Projects*

Once approved in the PDU and passed the budgeting stage, the development process of individual projects is less determined by regulation and can be more varied that individual PDU documents. Project developers (whether the AOTU or a contracted body) may choose to equally conduct optional studies, such as preliminary studies looking at project feasibility. This may often lead to a first phase of optional public consultation. After what can potentially take multiple iterations, project developers, whether public or private, are obliged to conduct statutory impact studies and a public inquiry. Up until the 2010 Grenelle II legislation, only projects with a budget over 1.9 million euros were subject to environmental impact study. However, since the *Grenelle II* legislation, this threshold has been abolished a new set of criteria, introducing notably impacts on human health, are currently being elaborated by the *Conseil d'Etat* (CERTU 2010).

France has a long tradition of project-related impact studies dating back to the 19th century. While originally linked to the declaration of the public utility (*utilité publique*) of a project, and thus whether the expropriation of private property can be justified, this impact analysis has increasingly included a broad range of environmental issues since the 1970s (Poutchy-Tixier 2004). The *Loi n°83-630 du 12 juillet 1983 relative à la démocratisation des enquêtes publiques et à la protection de l'environnement* instituted, as in the case of the analysis of planning documents described above, a system of public consultations and inquiry to improve the inclusion of the general population in decision making as well as better integrate potential impacts of a project on the environment.

Today, project developers are required to develop the documentation necessary for the two statutory steps within the development and approval process: the environmental impact study (*évaluation environnementale*) and the *Enquête publique préalable à la déclaration d'utilité publique*. The environmental evaluation (described below in the following section) must be conducted before the beginning of the public inquiry, and represent a broad analysis, including socio-economic aspects and social or health impacts on the populations affected (Poutchy-Tixier 2004). Once the environmental impact study is completed, it is integrated into the larger set of documents assembled for the public inquiry necessary for the *Declaration of Public Utility*. The processes follows the same process as described for the public inquiry surrounding plans and projects, including the notification of the public, the nomitation of a commissioner by the administrative courts as well as the final control of legality and of the environmental impact statement by the competent *préfet*. Once the process has been completed, the necessary changes are made to the project, which, if necessary, is approved in its final form by the executive body of the AOTU or other project manager. This typically takes the form of a *déclartion du projet*, which takes into consideration the potential impact, the opinion of the opinion of the State concerning the environmental impact study and the result of public consultation. It indicates, if any, the nature and reasons for major changes made to the project initially submitted for public inquiry. This *déclartion du projet* is necessary for the issuing of the required work permits to begin project construction (*Article L126-1 Code de l'environnement*).

ANNEX 6:
CLIMATE ACTION PLANS & INSTITUTIONAL STRUCTURE: GRENOBLE ALPES AND NANTES MÉTROPOLES

This annex presents a brief description of the two climate action plans that have been implemented in Grenoble Alpes Métropole and Nantes Métropole. Below, a brief history, the over-arching objectives, institutional structure and principal coordination and evaluation mechanisms are presented. Both cases are summarized in Table 39.

1. GRENOBLE ALPES METROPOLE

1.1. History

While the first climate action plan approved by Grenoble-Alpes Metropole (La Métro) dates from 2005, the treatment of environmental issues, and particularly local air pollution, has received careful attention since the creation of the ASCOPARG (*l'Association pour le suivi et le Contrôle de la Qualité de l'air de la Région Grenobloise*) in 1995 and the *Agence Locale de l'Energie et du climat* (ALEc) in 1998. Initially passed in 2005, and subsequently revised for the periods 2008-2010 and 2010-2014, the evolution of the climate action plan of La Métro has been marked be three phases. First, the initial evaluation of GHG emissions in 2001 and the formulation of actions to be taken internally and centrally controlled policies, culminating principally in the 2005 'Plan Climat'. A second phase, given the limitations of La Métro acting only on its policy competencies, was initiated to federate actors across the territory, including the individual communes, public agencies, private companies as well as State, regional and departmental actors together within a single process. Equally, a Scientific Council was established to work with both local as well as national and international experts in the development of the necessary technical expertise for both the development of implementation of policy. Finally, a third phase has been recently developed (2011) focusing on fostering behavioral change and emission reductions among the general population.

1.2. Objectives

La Métro has established ambition GHG emission reduction targets operating at different timescales for the territory under its jurisdiction. Current targets finalized in 2009 set that in the short run (2014), the will achieve a 14% reduction in CO2 emissions compared to 2005 levels. Medium term goals for 2020 adopt the European Union objectives of a 20% reduction in emissions. Finally, La Métro has equally adopted the national long-term objective of achieving the *Facteur 4* emission reductions for 2050. Internally, this equates to a 9% reduction in emissions for 2014. For the moment, no quantified sectoral division of emission reductions has occurred, although qualitative or related objectives, for example in transport in terms of modal share, have been established as stepping stones towards goals.

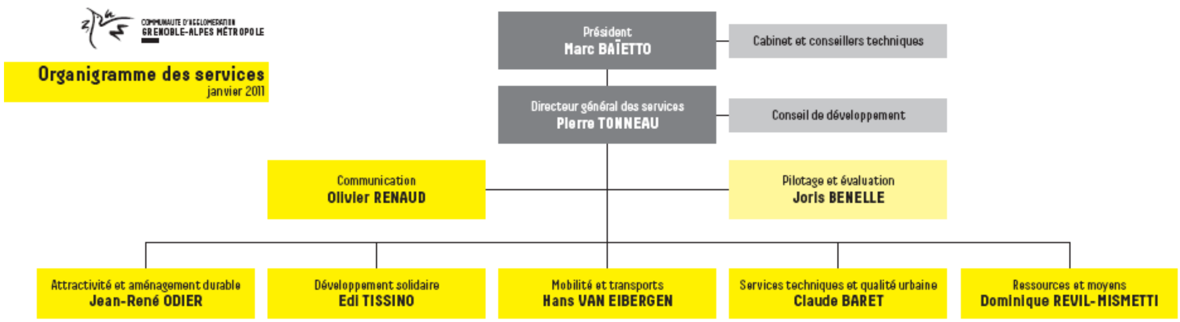
Table 74: GHG Reduction Targets in Relation to 2005 Emission Levels

In relation to 2005 levels	Territory	Internal
2014	- 14%	- 9%
2020	- 20 %	
2050	- 75 % (*Facteur 4*)	

1.3. Principal Institutional Organization

Since 2009/2010 climate change policy is coordinated by the *'Project Environnement'*, part of the transversal *Direction du pilotage de la performance gestionnaire et environnementale*. This transversal service under the direct authority of the Director General of Services of La Métro was created to introduce a logic of economic efficiency as well as an environmental perspective into the ensemble of the five principal directions[157] across the Métro. Before the creation of this service, climate policy was managed by the *pôle environnement* part of what was the *Direction des politiques urbaines*. However, since the creation of the *Direction du pilotage*, this pole has been rolled into the larger transversal structure.

Figure 28: Organisational structure of Grenoble Alpes Métropole



Source: Grenobles-Alpes Métropole (2011)

The *Project Environnement* works in close cooperation with a number of other agencies and associations in the development, implementation and evaluation of their GHG mitigation. As further discussed below, the *Agence Locale de l'Energie* plays an important role in working the different partners (communes, private companies, individuals) federated in the PCET process. The ASCOPARG, a technical non-profit agency focusing on monitoring the quality of air, has been an indispensible aid in providing the data necessary for the quantification of greenhouse gas emissions and tracking the impacts of actions. The *Agence d'urbanisme de la région grenobloise* (AURG) plays an equally important role in providing expertise as well as assisting in the development of adaptation policy.

157 5 Principal Directions : Attractivité et aménagement durable; Développement solidaire; Mobilité et transports; Services techniques et qualité urbaine; Ressources et moyens

1.4. Internal Coordination

As demanded for all actors engaged in La Métro's climat action plan, the *communauté d'agglomération* has elaborated a set of actions focusing on the reduction of internal, operational emissions targeting its jurisdictional competencies and operations: sanitation services, waste management, owned buildings. This plan equally tackles issues of internal organization, including employee commuting, eco-office practices. The ways in which the EPCI can influence economic development are further utilized, integrating the ADEME's *Environmental Approach of Urbanism* (AEU) for the development of business parks, as well as fostering the development of the biomass-energy industry. Internally, coordination between services occurs using the process created by the *European Energy Award* framework, a certification given to municipalities that have adopted a number of organizational practices and developed an action plan.

Box 7: The European Energy Award (Cit'ergie)

The European Energy Award is a certification processes that promotes the systematic review of all energy-related activities by a municipality. Structured around the process of identifying the actions that can be taken and understanding the potential means of action, the European Energy Award allows municipalities to identify strengths, weaknesses and potential for improvement and, above all, implement effectively energy efficient measures. Using a standardized benchmark between participating communities, the award is given after a tri-annual review.

The European Energy Award consists of two main elements:

- A quality management system for communal energy-related services and activities
- Certification and award for energy-related achievements and control of success through regular audits

The certification process is structured around a number of steps to improve energy-related performance:

* Review of energy-related activities
* Identification of strengths, weaknesses and potentials for improvement
* Definition of goals for local energy policy and decision-making criteria
* Development of an energy policy work programme, including both concrete long-term and short-term projects
* Implementation of a step-by-step work program
* On-going evaluation of progress towards goals

In 2010, the European Energy Award (EEA) was recognized by the European Commission as an efficient tool to implement the objectives of the Covenant of Mayors, the EU's flagship program to promoting greenhouse gas emission reductions among municipalities across the Union. In France, the EEA process, locally known as Cit'ergie, has been recognized by the ADEME as a means for municipalities to structure their action.

Source: Forum European Energy Award. "European Energy Award," n.d. http://www.european-energy-award.org/Home.59.0.html*.; ADEME. "Cit'ergie - European Energy Award," n.d. http://www.citergie.ademe.fr/label-citergie_dispositif-europeen.*

Stemming from the EPCI's participation in the 2005-2008 *Reve Jura-Leman* program, La Métro is certified EEA since 2007. It has developed an internal organization process directly connected to the climate action plan focusing on the definition and implementation of an internal action plan in line with the requirements of the EEA program. The creation of a transversal working group including representatives from all services to follow the implementation of the action plan. Dovetailed with a larger cost-accounting program developed by the *Direction de la pilotage*, la Métro is currently in the final stages of developing an accounting line to identify and track all spending related to the climate action plan.

1.5. External Coordination

External coordination of greenhouse gas emissions, as mentioned above, is under continued development. The first key element is the introduction and the use of the *charte d'engagement du plan climat* or a voluntary contract between each individual partner and La Métro engaging the entity, whether public or private, within the climate action plan process. As of 2011, over 70 partners have engaged themselves, including communes, private companies, public agencies such as the SMTC, universities, as well as the *Conseil Général de l'Isère* (*département*). By signing the *charte*, each actor engaged to participate in reaching the global GHG emission reduction targets established for the territory as well as develop an internal action plan to reduce their own direct emissions stemming from activities linked to their given competencies. They also engage to use their resources to communicate and work with their partners and clients, in the case of the communes, directly with the general public, in furthering learning on GHG mitigation and to foster action. Currently, the partners are working towards their 2014 engagements in terms of energy use and emission reductions. However, the commitment of each municipality in terms of energy consumption and emission of greenhouse gas reductions focuses only on their own buildings and their fleets of vehicles given that they control this directly. However, this represents only a small portion of energy consumption of the territory, since it is the municipal assets. (Poimboeuf 10.10.21)

The Agence Local d'Energie et du Climat (ALEc) manages the majority of the external coordination of the climate action plan. The AlEc was initially charged with this task as a means of depoliticizing climate and energy policy and to reduce the potential perception of the EPCI overstepping its jurisdictional boundaries in work with the communes, the private sector as well as the general population (Uhry 10.10.20). The ALEc works directly with the different partners and signers of the *charte*, assisting them in the identification of emission reduction potentials, development of actions and their rough quantification. The ALEc is also charged assisting partners as to how to organize themselves internally to achieve their goals as well as overseeing the yearly follow-up and reporting of the different partners of progress.[158]

The second portion of La Métro's external coordination efforts focuses on the engagement of the general population in the climate action plan process. The principal tool

[158] Each partner fills out a official 'fiche de suivie' developed and provided by the ALEc which lists the actions, their potential emission reduction impact as well as progress towards achieving these actions.

used by the Métro to engage the general public is the *Plan d'Actions Transversal* which aims to put into place communication and information provision actions. These actions, occurring over the period 2005-2006 and 2007-2008. These actions have included pubic demonstration projects on climate and energy-efficiency related topics, the development of different guides, education programs for commune employees as well as a labeling program for public buildings. Further, while still in its embryonic stages, the Métro has already run into significant conflict from communes who do not see that it is the role of the EPCI to be directly interfacing with the general population, as this has been traditionally the role of the commune to do so (Durand 10.10.12, Poimboeuf 10.10.21). The Métro is attempting to find a means of working with the networks and the connections both between the communes and the population, as well as different organizations involved in these subjects, as not to add an additional layer of complexity to coordination.

1.6. Use of GHG Inventory Tools

An important part of the climate strategy of Grenoble Alpes Métropole has been the production and use of greenhouse gas inventories and related informational tools. These different tools have a variety of functions ranging from the identification of emission sources, the development of emission reduction strategies and scenarios to the detailed evaluation of individual emission reduction projects. As seen in Table 75, Grenoble Alpes Métropole has developed three principal types of greenhouse gas inventories directly involved in the application of their PCET. These different types of inventories reflect different uses as well as the relative cost of their production due to data requirements.

The principal tool is Grenoble Alpes Métropole's annual energy and greenhouse gas emission inventory which has been conducted in various forms since 1999. Conducted at the scale of the entire administrative territory, the inventory reports the direct emissions (Scope 1) from activities as well as GHG emissions from imported electricity and energy use (Scope 2). Based principally on data on the real consumption of different fuels and energy sources, the inventory presents a detailed diagnostic of energy use and emissions from industry, the residential and tertiary buildings, agriculture and transport. This inventory has played an important role in initially identifying emission sources as well as providing a means of tracking progress annually (Filhol 10.10.18). A number of technical barriers remain in terms of how to weight inventory results to identify what portion of emissions stem from policies and actions versus variation in economic activity, weather and other trends (Buffiere 10.10.19). Nevertheless, the inventory has provided the different actors involved with an important policy tool for tracking and communicating progress.

The individual communes and other partners that have signed on to the PCET process through the Charte d'engagement produce a second set of annual inventories linked to their individual mitigation plans. The ALEc works annually with each commune to quantify the communes greenhouse gas emissions and identify the policies to be taken to reach the -14% emission reduction target. Using the direct energy consumption data of each PCET partner, inventory focuses on the emissions from direct operational activities. As a tool, these inventories have a didactic purpose in assisting each actor to understand the types and magnitude of actions necessary to achieve the targets.

The third type of GHG inventory tool used within the PCET process focuses on individual services and projects. Taking a more detailed approach, these inventories typically take into consideration all emission Scopes (1, 2 and 3), thus take a lifecycle approach to identify both the direct and indirect emissions both upstream and downstream. Much more data intensive and thus typically more expensive, these tools are used to focus on a specific action or service (such as waste collection and treatment) to develop a holistic profile of emission sources and potential reduction options.

Table 75: GHG Quantification Tools implemented by Grenoble Alpes Métropole

	Bilan énérgétique Grenoble Alpes Métropole	**Plan Climat Action Plans (communes, private actors)**	**Inventory Services & Projects**
Objective	- Diagnostic & Tracking (since 1999) - Scenarios for 2020 (high and low scenarios)	- Estimation of emission reductions from proposed actions with Climate Action Plans	- Diagnostic of individual services - Calculate emission reduction potential
Frequency	- Annual	- Annual	- Dependent
Scopes	- 1 Direct Emissions - 2 Imported electricity & heat/cooling	- 1 Direct Emissions - 2 Imported electricity & heat/cooling	- 1 Direct Emissions - 2 Imported electricity & heat/cooling - 3 Indirect Emissions
Perimeter	- Total territorial emissions	- Operational emissions	- Operational emissions
Involved actors	- ALEc (principal) - ASCOPARG - Private consultant (Explicit)*	- ALEc (principal) - Partners of the Charte d'engagelent of PCET - ASCOPARG	- ALEc (principal) - ASCOPARG - Private consultant
*Private consultant involved in first inventory conducted in 1999, however since then it has been conducted internally by the ALEc			

It is important to look at the institutional arrangements that have been put into place to coordinate the production and use of expertise and information on greenhouse gas inventories. To coordinate the production of the territorial inventory, Grenoble Alpes Métropole has created a GHG Observatory (*Observatoire du Plan Climat*) based within the ALEc. Rather than working each year with an external consultant to conduct the inventory as occurs elsewhere, la Métro has chosen to develop this capacity internally (Poimboeuf 10.03.01). As such, they are able to ensure a better long-term appropriation of the GHG expertise by both technical staff as well as elected officials and have developed methodological tools tailored to the needs and data availability of the communauté d'agglomération. The Métro has also established long term partnerships with a number of associations and NGOs such as the ASCOPARG as well as a number of technical bodies at the regional level. These external partners typically play a key role in the provision of technical expertise, data and analysis needed to develop and maintain the different inventory tools.

A number of interviewees indicated that the development of this information has aided in the appropriation of greenhouse gas mitigation as a policy issue by both elected officials as well as staff. While not adopted by all actors, the development of a common "language" with which GHG mitigation efforts can be planned and discussed has helped many better understand the role they have to play in achieve emission reduction objectives (Buffiere 10.10.19; Filhol 10.10.19; Poilboeuf 10.10.21; Uhry 10.10.20). Further, when combined with the Charte d'engagements and the different action plans developed by the different partners, actors are able to translate commitments into concrete actions. In some instances, having a quantified action plans has pushed actors to develop new GHG mitigation projects when existing projects fall through or are recognized as not being sufficient (Goubel 10.10.19).

It is equally important to note that a number of nascent tools are in development by the different services within the Métro to mainstreaming greenhouse gas mitigation into individual policy streams. While often not directly connected to the PCET, these tools (discussed in chapter x) serve to integrate GHG mitigation into often isular decision-making process surrounding the SCoT, PDU and individual infrastructure projects.

Table 76: GHG Quantification Tools Form Mainstreaming into other policy streams implemented by Grenoble Alpes Métropole

	Environmental Evaluation of SCoT	**Environmental Evaluation of PDU 2012-2015**	**SMTC Line B (2005), C, and E**
Objective	- Diagnostic of territory (baseline) - Assessment of SCoT Scenarios (*in progress*)	- Diagnostic of territory (baseline) - Assessment of PDU scenarios (*in progress)*	- Analysis of yearly savings in CO2eq as part of larger Cost-Benefit Analysis (once project completed)
Frequenc y	- Every 6 years (statutory)	- To be determined	- Single shot
Scopes	- Territorial emissions	- Transport planning perimeter (territorial)	- Project-related emissions
Involved actors	- Private consultants (Explicit, Alnair) - Oversight of Métro and ALEc	- External Consultant - Oversight of SMTC - Consultation with Metro +ALEc - ASCOPARG	- SMTC - Private Consultant (INGEROP) - ASCOPARG

1.7. PCET Finance

While information on the total budget of Grenoble Alpes Métropoles climate action program, La Métro has made a number of substantial investments on individual programs. For example, La Métro plans to invest over 10 million euros between 2010-2014 in their *mur/mur* energy efficiency and retrofitting of residential buildings as well as the investment of 3.5 million euro in a co-generation waste project (CERTU 2011). Nevertheless, interviewees indicated that a number of difficulties remain in assuring the necessary finance for the implementation of individual GHG mitigation projects, but also in terms of funding the larger engagement of climate partners and coordination process. As discussed in Chapter 3, actors have encountered a number of technical problems due to the complexity of climate related financing. Specifically, actors have noted that identifying what portion of financing of a project was “additional” or allowed for the reduction of GHG emissions can be a significant challenge. For example, given that the extension of public transportation is included in the climate action plan, what percentage of the total financing of a tramway project should be counted as part of the PCET budget? Given that communicating on the financial commitment of the C.A. in terms of climate financing is important, this continues to pose difficulties (Poimboeuf 10.10.21). Secondly, when financing is available, it continues to flow along sectoral lines. As such, financing for transport project may be more readily available than financing for residential rehabilitation projects or other equally necessary programs (Pezet Kuhn 10.03.02). Finally, actors in the *Agence locale d’energie et du climat* noted the limitations on financing for the implementation of policy and the funding of staff positions to work with PCET partners and signatories of the *charte d’engagements* (Goubel 10.10.19). Given that the ambitious GHG objectives set by the C.A. will require the participation of a large portion both public and private actors active within the territory, ensuring the needed funding for non-project oriented budgets can be a challenge.

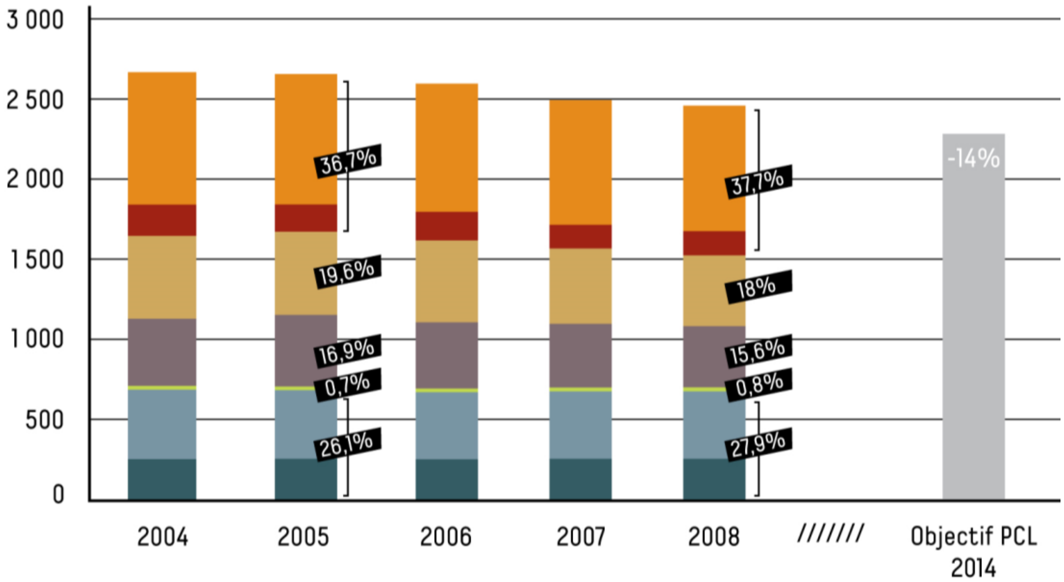
1.8. Evaluation

La Métro has paid careful attention to the development of an evaluation system of its climate policy. Since the initial 2001 greenhouse gas inventory and diagnostic of emissions conducted by the external consultant Explicit, the Métro has worked to develop an internal competency in terms of GHG quantification, tracking of progress and the evaluation of actions. Based within the ALEc, the *Observatoire du Plan Climat* produces a yearly (n-1) quantification of energy consumption and greenhouse gas emissions at the scale of the communauté d’agglomération.[159] This tool has allowed the agglomeration to follow progress towards their emission reduction objective totals. As seen in Figure 17, GHG emissions have been reduced by 7.4% corresponding to a 5.4% reduction in energy consumption between 2004 and 2008. While actions appear to have stabilized transport-related GHG emissions, the majority of reductions appear to stem from the residential sector.

Additionally, as mentioned above, the development of the *comptabilité carbone* for the different services is expected, once fully in place, to trace the cost efficiency of GHG reduction actions through the identification and classification of spending (something that to date has proven difficult to do). Finally, each partner within the charter process must report on its progress towards meeting its emission reduction objectives annually (although there are no binding consequences if reporting does not occur or if targets are not met). Progress and results are discussed among the different partners every six months during the Forum du Plan Climat organized by the Métro and the ALEc.

[159] Mtons CO2e/ year by sector ; GWh energy consumption / year by sector

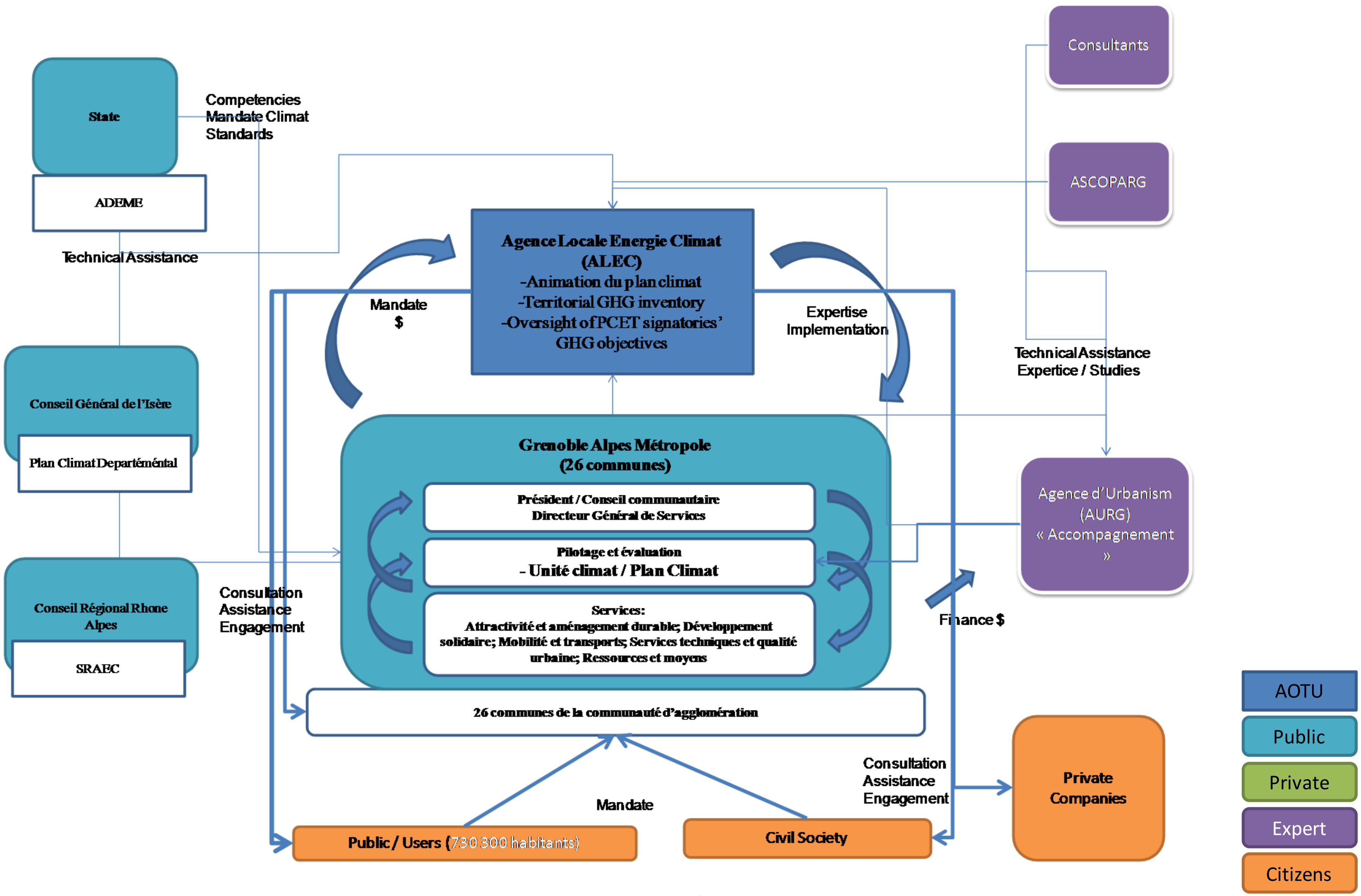
Figure 29: Evolution of GHG emissions in Grenoble Alpes Métrpole 2004-2008



	Commerical transport		Agricutlure		Residential		Small Industry
	Passenger transport		Service Sector				Industry in ETS

Source: La Métro 2009

Figure 30: Diagram of Climate Policy Actiors and Processes in Grenoble Alpes Métropole



2. NANTES MÉTROPOLE

2.1. History

The climate action plan of Nantes Métropole, first approuved in 2007, stems from close to a decade previous work on energy and sustainable-development related issues by the communauté urbaine. Beginning with the Contrat ATEnEE[160] between the ADEME and Nantes in 2003-2006 and followed by the approval of both the Agned 21 Local (where the fight against climate change is at the top of the list of 21 actions) and a Plan Pluriannuel d'Actions pour l'Energie[161], the issue of climate change, energy consumption and greenhouse gas emissions has held a privileged place within the development of the EPCI's larger strategy. The *Cadre Stratégique du Plan Climat Territorial* was passed in 2007, setting out the larger strategy and framework for climate action.

It is important to note a significant 'inflection' in terms of the management of climate policy in the communauté urbaine after the 2008 elections and the arrival of new Director Générale des Services. At this moment what could be categorized as a more technocratic-oriented process based around purely technical studies was opened up to a large number of actors with an emphasis on the engagement of civil society. As part of the 'appropriation' of the subject by the new Director Générale, a reoriented and restructured climate action plan was issued in 2009 (Guillard 10.12.07). Studies had indicated that the C.U. could only influence a small portion of total GHG emissions within their jurisdiction through its direct competencies. As such, a need was recognized to engage both the individual communes as well as the range of public and private actors within their jurisdiction. This 'Phase 2' of the climate action plan, made up of a program of operational actions to both coordination emission reductions across the communauté urbaines as well as engage with external actors and the communes as well as a the creation of a scientific council to advice the CU on technical issues. The most recent phase, marked by the signature of a protocol of partnership between the ADEME and Nantes Métropole services to identify and put into place the policies and actions to facilitate the reduction of greenhouse gas emissions by actors across the territory.

2.2. Objectives

The greenhouse gas emission objectives of Nantes Métropole are in line with national and international targets. As established by the *Cadre Stratégique du Plan Climat Territorial* in 2007, the C.U. wishes to reduce emissions across the territory by 50% by 2025 and by 75%

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[160] Actions Territoriales pour l'Environnement et l'Efficacité Energétique contracts are established by the ADEME and newly created intercommunal structures to facilitate the integration of environmental, energy efficiency and the reduction of greenhouse gas emissions into the larger vision for the territory.

[161] Operational action plan for the orientations concerning energy efficiecy identified in 2005. This plan was accompanied by a development of the internal expertise of Nantes Metropole with the creation of a 'Mission Energy' and a Pole climate-greenhouse effect' within the larger Mission for Sustainable Development and Natural Zones in 2005.

by 2050 using 1990 levels as a baseline. Today, this translates to the needed reduction of approximately a total of 1 million tons CO2e by 2025, or 55,500 tons CO2e annually. Given that in that using the reference year of 1990 that in 2007 the communauté urbaine had already achieved a 24% reduction in emissions, they have already made substantial progress to meeting their targets. These objectives have not yet been broken down by departments and services in terms of the attribution of specific GHG reduction targets (Guillard 10.12.07). Further, the C.U. recognizes that to achieve their objectives, the entire territory must be engaged in the process as the C.U. only has direct control over less than 6% of the total emissions across the territory (GSP 2010).

Table 77: GHG Reduction Targets in Relation to 1990 Emission Levels

In relation to 1990 levels[162]	Territory
2025	- 50 %
2050	- 75% (Facteur 4)

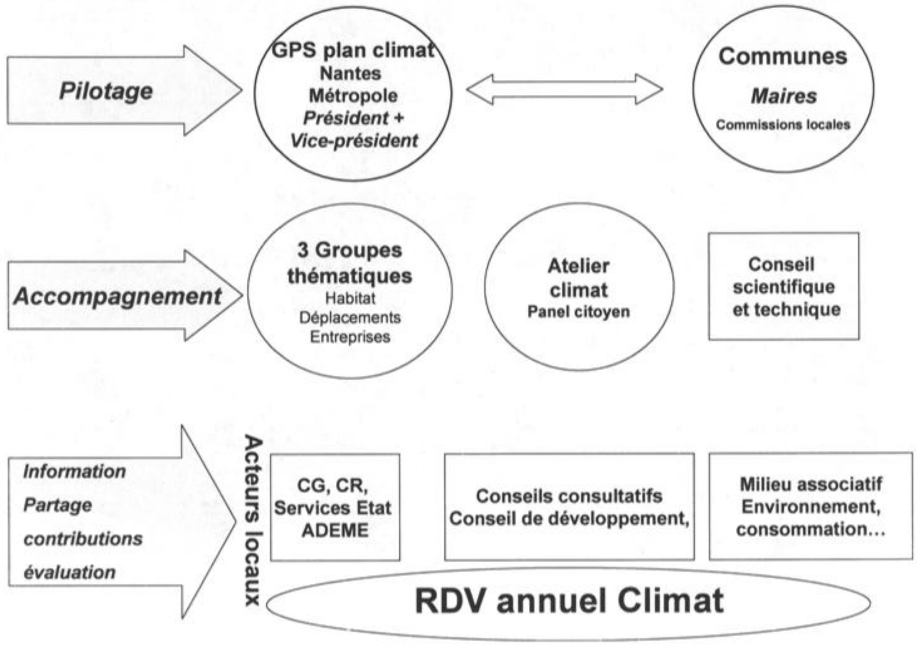
2.3. *Principal Organization*

While the institutional arrangements surrounding the management of climate change policy has evolved over time in Nantes Métropole, and since 2008 involve some of the most senior staff of the communauté urbaine. The director of the climate action plan project is officially the Assistant Director General of the communauté urbaine, with heavy oversight by the Director General himself since 2008 (Guillard 10.12.07). The ‘chef de projet’ is the head of the newly-created 5-person *Service Animation Developpement Durable et Climat* embedded within the *Direction Générale Envrionnement et Services Urbains*. While not limited only to climate change topics, this service includes full-time staff dedicated to quantification, internal implementation of policies as well as coordination externally. As indicated by the title of its service, its most important task is working to ‘animate’ or work to develop and implement greenhouse gas reduction policy through both internal and external coordination.

In general, the communauté urbaine has been able to utilize the existing working structure stemming from the development and implementation of the various Agenda 21 processes. This has led to the development of a culture of transversal cooperation facilitated by a project and working group federating services across the different divisions of the C.U. The C.U. also works with a number of partners in the development and implementation of greenhouse gas policy, including the regional office of the ADEME as well as more recently Air Pays de la Loire, the AASQA in the region.

[162] Date of first GHG inventory at the scale of Nantes Métropole, although the communauté urbaine had not yet been created (District).

Figure 31: Organization of Climate Policy in Nantes Métropole



Source: Nantes Métropole, 'Plan Climat De Nantes Métropole - GPS Plan Climat Du 01/04/10', 2010.

2.4. Internal Coordination

Transversal coordination of climate change policy in Nantes Métropole occurs at a number of different levels. At the highest 'political' level, the *GPS plan climat*, a working group meeting throughout year, brings together both the president and vice president of Nantes Métropole into the oversight of the process.

Sectorally, a network of *referants thématiques* have been identified across the different directorates of the communatué urbaine who liaise with the *Service Animation Developpement Durable et Climat* with the objective of integrating an analysis and understanding of greenhouse gas mitigation into the different policy streams. For example, in the development of the 2010-2015 PDU, the *Service Animation Developpement Durable et Climat* worked closely with Emily Ranty in the Direction Générale Déplacements in the development of GHG analysis criteria integrated into the statutory environmental evaluation. These *referants* are equally involved in the thematic groups, described below (Huré 10.12.08).

Since the change in approach which marked 2008, a significant effort has gone into the identification of policies already in place leading to greenhouse gas emissions reductions rather than the development of new actions. Called the *Mobalisation des politiques publiques*, this approach attempts to give a measure of visibility to climate change issues through direct interfacing with each individual directorates. Part of a larger process of rationalizing all policy actions taken by the C.U. focusing on the performance-based sorting of all policies and actions into ten principal categories as well as the identification of the principal actor(s), the consecrated resources, the timeline as well as the indicators for evaluation. The principal objective of the efforts led by the *Service DD Climat* is to understand how these policies contribute the GHG mitigation goals subscribed to by the C.U. through the Covenant of mayors. The identified action, initially called the '100 actions', but in reality closer to 200, are used to construct the climate action plan. This is an ambitious program that holds strong potential as both a learning tool for individual directorates and services as well as in developing a vision of the impacts of the combined actions of the C.U. (Mallet 10.12.07) It has equally served as the basis for the reporting required by the EU Covenant of Mayors program. However, there are a number of limitations to this process. While this approach does increase transparency in terms of what is currently being undertaken, and does in some ways increase visibility of the issue among different actors, it does not seem to specifically coordinate actions between services nor lead necessarily to the development of new emission reduction projects or limit increases in emissions. Further, and perhaps more concerning, there is no concurrent analysis of actions that could potentially lead to increases in emissions. As such, a skewed vision of the impacts of the C.U.'s public policies may be produced.

A series of seminars focusing on improving communication between the different directorates concerning common projects and focusing on the 'new management culture', including a greenhouse gas emissions and other sustainable development criteria, are also in development (Mallet 10.10.08).

2.5. External Coordination

The *Service Animation Developpement Durable et Climat* is equally charged with the coordination of greenhouse gas emission mitigation with external actors.

As a communauté urbaine, Nantes Métropole has a wider range of jurisdictional competencies and more formalized hierarchical relationships with the individual communes than other, less-unified, forms of intercommunal cooperation. Instead of using a system of contracts to engage the individual communes, the *Service Animation* uses the existing institutional framework and networks within the C.U. to coordinate policy with individual communes. The principal engagement of communes occurs not only through the approval of the *Cadre strategique* as well as subsequent climate action plans, but also through the adoption and ratification of the participation of Nantes Métropole in the Covenant of Mayors program. As seen in Box 8, the Covenant of Mayors sets emission reduction objectives for participating municipal authorities in line with the EU 20/20/20 targets. It equally requires the formulation of a plan of actions to achieve their emission reduction targets. Each individual mayor of the communes making up the C.U., through approval of the participation of Nantes Métropole in this process, equally committed themselves to reaching the targets (Boesflug 10.12.06).

Coordination with the communes occurs principally through the network of relationships initially created during the development and implementation of the Agenda 21 (Mallet 10.12.08) as well as through the *Poles de proximité* (Mallet 10.12.07), part of the larger institutional structure of the C.U. Through the existing networks, the *Service Animation* works with both elected officials as well as technical staff to better integrate GHG mitigation into policies (Mallet 10.12.08). Coordination equally occurs through the *Poles de Proximité* or the decentralized offices of the C.U. charged with working directly with the communes. These poles are expected to provide principally technical support and expertise in the development and implementation of actions (Mallet 10.12.08). Finally, the C.U. has an important role in providing the necessary technical support to communes. An example of this is the provision of energy consumption and greenhouse gas emission data to each individual commune to assist them in the development of their policies.

Box 8: Covenant of Mayors

Recognizing the importance of cities and local authorities in achieving its ambitious goal of reducing GHG emissions by 20% by 2020, the European Union launched the Covenant of Mayors initiative in January of 2008. A results-based voluntary process targeting cities and regions, signatories of the covenant formally commit to reduce their CO2 emissions more than 20% by 2020. Failure to meet this objective will lead to their exclusion from the covenant.

The Covenant of Mayors requires that signatories develop Sustainable Energy Action Plans (SEAPs) using a quantified GHG inventory and baseline as a point of departure. Both the commitment to join the covenant and the produced action plan must be formal documents, officially approved by the respective City Council or respective decisional body in order to formalize and concretize the participation. While the European Commission and the Covenant do not provide grants for the development and implementation of the SEAPs, the European Investment Bank has created ELENA, a dedicated technical assistance facility as work with signatories in securing financing. It is the hope of the covenant that through raising the profile of local-level commitments and the development of concrete actions to reach emission reduction targets will assist local authorities in identifying and securing the necessary financing from both market and national-government sources.

As of August 2011, there are over 2809 signatories of the covenant. However it is important to note that of the 127 signatories in France, only a little over 15% have submitted the required SEAPs.

Source: http://www.eumayors.eu/index_en.html

While as a communauté urbaine Nantes Métropole has direct control over a broader range of competencies than a communauté d'agglomération, it is still important that the individual communes develop GHG emission reduction policies not only to reduce their direct emissions, but also to work directly with the general population. As such, communes such as the Ville de Nantes have launched independent efforts – in this case the certification process for the European Energy Award (see Box 7). Principally organized by the commune, the project equally receives support from the communauté urbaine (Boesflug 10.12.06; Mallet 10.12.07; Guillard 10.12.07).

To engage a larger swath of the private and civil society actors across the territory, Nantes Métropole has developed a number of additional programs often brining together a range of different actors. Firstly, the thematic groups (*Groupes thématiques*) structured around three principal topics, housing, mobility and private companies (enterprises) bring together both relevant actors from the C.U., piloted from by the vice president of the directorate concerned, as well as a range of different representatives from the private sector and civil society to promote both learning, but as well as discussion concerning appropriate solutions, obstacles, etc. Still in development, it is expected that these groups will meet multiple times per year. To further engage the business community, the C.U. is planning to work through a number of existing structure to layer in climate change-related subjects. This includes working through existing staff in each *pole de proximité* charged with economic development to integrate climate issues into existing projects, such as the *Club d'entreprises,* etc. The C.U. is equally planning to work with the local Chamber of Commerce (*Chambre de Métiers*) to leverage existing structures.

Further efforts are equally planned in terms of leveraging citizen action and civil society, principally focused around communication and fostering learning. A telephone hotline, *Allo Climat* has been launched to respond directly to the individual questions. An *Ecopôle* resource and counseling center is in development to provide more detailed information than hotline. This will paired with the creation of an *animateur climat* with the *poles de proximité* to interface directly with the larger public. The existing program (EIE) will equally be expanded in partnership with the ADEME and other associations. Finally, the C.U. has put together an *Atelier Climat* program that has initially surveyed 2500 households and will over the long term work with 150 households within the *communauté urbaine*. This multi-year program aims to identify the potential opportunities and means of promoting behavioural change as well as test a variety of public policies (Guillard 10.12.08).

2.6. Use of GHG Inventory Tools

Nantes Métropole has constructed a number of informational tools to further and support the development and implementation of their greenhouse gas mitigation strategy. As seen in Table 78, these tools have taken three levels of focus. Firstly, at the macro scale, a number of territory-wide inventories have been used to better understand the total emissions within the C.U.'s jurisdictional perimeter. At the meso-scale, the C.U. has worked with individual départements and services to quantify the greenhouse gas reductions stemming from existing policies and actions. Finally, a micro-scale lifecycle approach has been used to quantify in detail a number of individual services and programs.

Since 1993, authorities in the Nantes urban area have conducted inventories of greenhouse gas emissions at the scale of their jurisdiction. Predating the communauté urbaine itself, the first study focused principally on the direct greenhouse gas emissions stemming from energy use. Extensively used as a baseline to set emission reduction objectives and track progress, this initial study allowed authorities to identify the principal source of emissions. Using data from 2003, a second territory-wide study was conducted in 2006 to support the development of emission reduction objectives and scenarios for Nantes Métropole within the framework of the 2006 PCET. Using a similar methodological approach, the 2006 inventory was expanded to include non-energy emission sources with results broken down at the scale of the individual communes (although emissions are not broken down by the jurisidictional competencies of the different actors active within the given perimeter). In both cases, authorities called on an external consultant (Explicit) to conduct these similar, but one-shot inventory which for the moment do not provide an annual tracking of changes in emission.

Secondly, as mentioned above, the communauté urbaine has attempted to roughly quantify the potential and actual greenhouse emission reductions stemming from the full range of policies and actions implemented by individual departments and services. Part of the larger reporting process for their participation in the Covenant of Mayors, the *100 Actions* quantification program has established a framework for the *Service Animation Development Durable et Climat* to work the sectoral department and actors to better understand how they contribute to GHG mitigation efforts. Focusing to date only on those actions that reduce GHG emissions, the process aims to understand how different actions affect emissions rather than construct a comprehensive and precise inventory. As such, the methodologies employed focus on capturing the order of magnitude of mitigation potential of an action, rather than quantify precisely the actual reduction.

Finally, at the micro scale, the communauté urbaine and the *Service Animation Development Durable et Climat* have worked with external consultants to conduct life-cycle analyses of specific projects and public services. These in-depth analysis of specific policy areas, such as water and waste treatment, water provision as well as public spaces. The objective of these often highly detailed analysis is not to identify potential means of GHG mitigation, but also to educate the full range of actors to the GHG mitigation policy challenge. As such, instead of using an external consultant to deliver a final report, the *Service Climat* works with the different departments and services to co-construct the lifecycle analysis (Gouritan 10.12.08). While a lifecycle approach is taken, often including both direct and indirect emissions, the objective of the process is focused on promoting comprehension than achieving a perfectly exact accounting of emissions. As such, issues such as double counting are often put to one side with a priority on understanding the extent of the impact of each action (Huré 10.12.09).

As seen in the case of Grenoble, Nantes Métropole has equally begun to develop an institutional capacity to internalize the production of GHG expertise. Since the creation of the larger *Services Animation Development Durable et Climat*, a staff member has been charged with the quantification question. Noting a lack of appropriation and long-term coherence of the different methodologies deployed by external consultants, the C.U. has acted upon a desire to establish an internal capacity on this subject (Guillard 10.02.17; Huré 10.12.08). Recognizing that inventories and the necessary technical capacities are necessary for managing a complex, intangible pollutant such as greenhouse gas emissions, the C.A. has begun to develop the necessary competencies to need to go from data to action (Mallet 10.12.09; Huré 10.12.08; Guillard 10.12.147). As such, the *Services Climat* is in a position to provide expert input and assistance and work with other departments and services in quantifying their GHG emissions.

Table 78: GHG Quantification Tools implemented by Nantes Métropole

	Territorial Inventories			
	1993 District GHG Inventory	2006 Communauté Urbaine Inventory	Quantification of policy actions (100 Actions)	Bilan Carbone de Services Publiques
Objective	- Diagnostic of energy use and related emissions	- Diagnostic - Development of mitigation scenarios - Cadre stratégique 2006	- Diagnostic of public policies and actions implemented by the C.U. - Reporting (Covenant of Mayors report)	- Lifecycle diagnostic of individual departments and projects - Educate involved actors
Frequency	One-shot	One-shot	Continual	Dependent
Scopes	- 1 Direct Emissions - 2 Imported electricity & heat/cooling	- 1 Direct Emissions - 2 Imported electricity & heat/cooling	- 1 Direct Emissions - 2 Imported electricity & heat/cooling	- 1 Direct Emissions - 2 Imported electricity & heat/cooling - 3 Indirect Emissions
Perimeter	- Total territorial emissions from energy use	- Total territorial emissions	- Operational emissions	- Operational emissions
Involved actors	- External consultant (Explicit)	- External Consultant (Explicit)	- Service DD Climat - Co-construction of inventories with concerned departments	- Service DD Climat - Co-construction of inventories with concerned departments - Limited technical aid from external consultants

Accompanying this development of an institutional capacity for GHG quantification is a further recognition that the appropriation of a both climate change as a policy subject and a new "language" to discuss GHG emissions is a long-term process measured in years (Mallet 10.12.08). An important component of the appropriation has been the contextualization of the different measures to specific sectors through a continual dialogue: identifying the most appropriate unit and educating as to what it measures as well as how it can be used to influence action (Huré 10.12.08). Actors interviewed recognized that progress has been made in terms of educating both elected and staff on the subject: a network of contacts and referees has been put into place, inventories have been co-constructed, and in some policy sectors specialized quantification tools have been developed. For example, as described further in Chapter 5, a qualitative and quantitative analysis of the impacts of the PDU on greenhouse gas emissions was integrated into the decision-making process through the statutory environmental analysis.

The next step recognized by Nantes Métropole in terms of the necessary inventory tools is the development of an annual territory-wide tool that will allow the C.U. to track its progress towards its greenhouse gas mitigation objectives. Working with the regional AASQA Aire Pays de la Loire, the C.U. is currently developing a tool that will do this at the perimeter of the SCoT (thus including the neighboring urban region of Saint Nazaire). Based on a emissions tool already calibrated for all air pollutants deployed at the scale of the région, the BASEMIS project has significant potential to be an important strategic tool for both internal accountability as well performance-based finance.

2.7. PCET Finance

Little information is available concerning the financing of climate actions in Nantes Métropole. At the time of writing, no consolidated figures were available concerning investment and implementation of GHG mitigation-related policies. In terms of funding their actions, the C.U. has identified a number of different possibilities. These options firstly include a number of classic funding systems, including conventional borrowing from the banking sector, the issuing of bonds. Secondly, the C.U. is exploring a number of more complex mechanisms including loan guarantee companies (third-party financing) as well as preferential rate loans or assistance from public finance institutions such as the Caisse des Dépôts or the European Investment Bank.

A number of specific programs have been financed as part of the PCET and the larger Agenda 21. To foster the redevelopment of the relatively large social housing stock in the C.U., Nantes Métropole has created the Community fund for energy efficiency in social housing (*Le fonds communautaire pour la performance énergétique dans le logement social*). Totaling 400,000 euros, this fund encourages and supports the social housing landloards to build energy efficient facilities. This fund has subsidized energy efficiency measures in 859 units with an estimate cost saving of 70 euros per household/year (Nantes Métropole 2008; CERTU 2011). Nevertheless, there is a clear recognition that current sources of financing are not sufficient to both maintain the planned rate of investment in the *Programme local d'habitation* as well as achieve energy efficiency objectives (Boesflug 10.12.07).

As mentioned above, Nantes Métropole is currently working with a consortium of other actors, including the Communauté Urbaine de Strasbourg and Grand Lyon as well as the three respective regional AASQAs to develop a performance-based financing mechanism. Recognizing the transversal nature of greenhouse gas emissions, this mechanism aims to link territory-wide GHG mitigation performance to different sources of financing. As such, reductions in GHG emissions could lead to non-sectorally linked financial flows that could be invested in a number of sectors across the C.U. Still in its initial stages of development, it is hoped that the mechanism will be tested at the scale of the SCOT of Nantes Métropole in 2013.

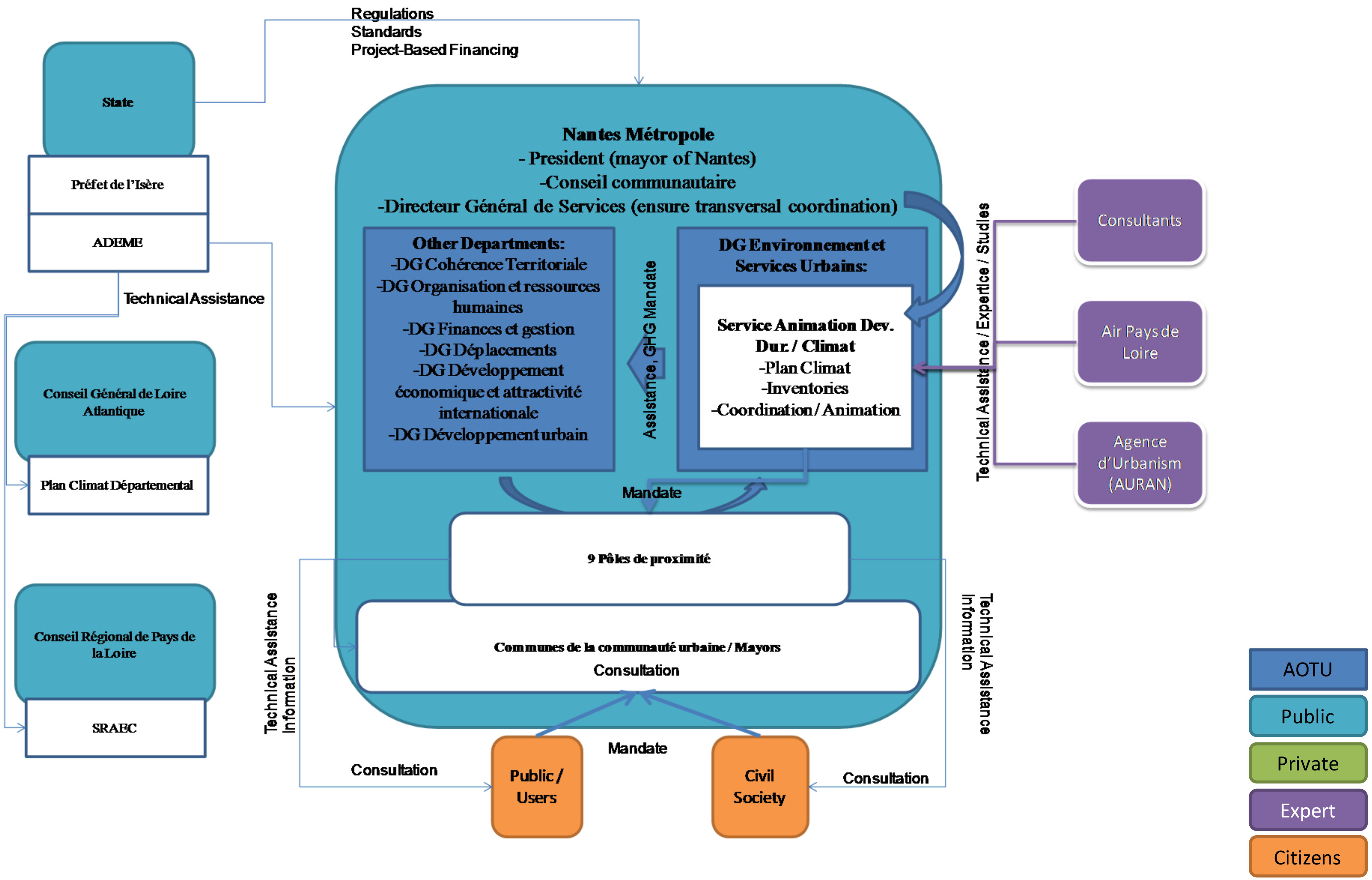
2.8. Evaluation

With the shift towards performance-based management of all public policy flows, the *Mobilisation des politiques publiques* and the quantification of the (if only positive) impacts of public policies is key component of evaluating the larger actions of the communauté urbaine in terms of their impact on greenhouse gas emissions. While Nantes Métropole has not created an *Observatoire* to produce yearly estimations of greenhouse gas emissions, since the creation of the *Service Animiation*, an important effort has been made to internalize the

GHG quantification capacity to develop more long-term tracking capacities. Nantes Métropole is also currently working with Air Pays de la Loire and a number of other partners in the development of a GHG quantification tool that could be used to estimate yearly the emissions of the entire territory. This would be an important step as currently no territory-wide GHG emission inventory has been produced since 2006, based on 2005 data.

An important part of Nantes Métropole's evaluation process is equally the annual '*Rendez-Vous Climat'* which brings together all of the actors from both the public and private sectors as well as individual citizens. Its objective is to each year gather to present the progress made in terms of the climate action plan, discuss as well as share results from different studies and experiences either conducted internally, by the scientific council or from the general public (Guillard 10.12.08).

Figure 32: Diagram of Climate Policy Actiors and Processes in Nantes Métropole



ANNEX 7:
MULTICRITERIA ANALYSIS PROJECT EVALUATION MATRIX

Field	Nature	Qualitative description of impacts	Valuation of impacts (1)
Environment and Risks	Climate		
	Local air pollution		
	Noise		
	Aquatic environments		
	Bio-diversity		
	Landscapes		
	Soils		
	Safety, Security, Risks		
Social	Employment		
	Vulnerable groups, poverty		
	Redistributive effects		
	Training, human capital		
	Access to essential goods and services		
	Territorial cohesion, social mix		
Economy	Impacts on households		
	Impacts on firms		
	Total cost		
	Cost for public finances and fiscal impacts		
	Competitiveness and additional economic effects (2)		
Other			

(1) Value expressed in monetary or physical units; failing that, scope of the impact: from negligible to extremely high.
(2) Some potentially important effects on the economy could be gradually factored in to the cost-benefit analyses: agglomeration economies, impacts on the markets in imperfect competition situations, impacts on the labour market and their fiscal consequences, etc. Moreover, the impacts mentioned in the table shall specify, for each criterion, the main risks and uncertainties that may have been identified and the main information concerning impact distribution.

Source: Quinet 2011